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Dräger medical

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Technical Service Manual

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Narkomed GS Anesthesia System

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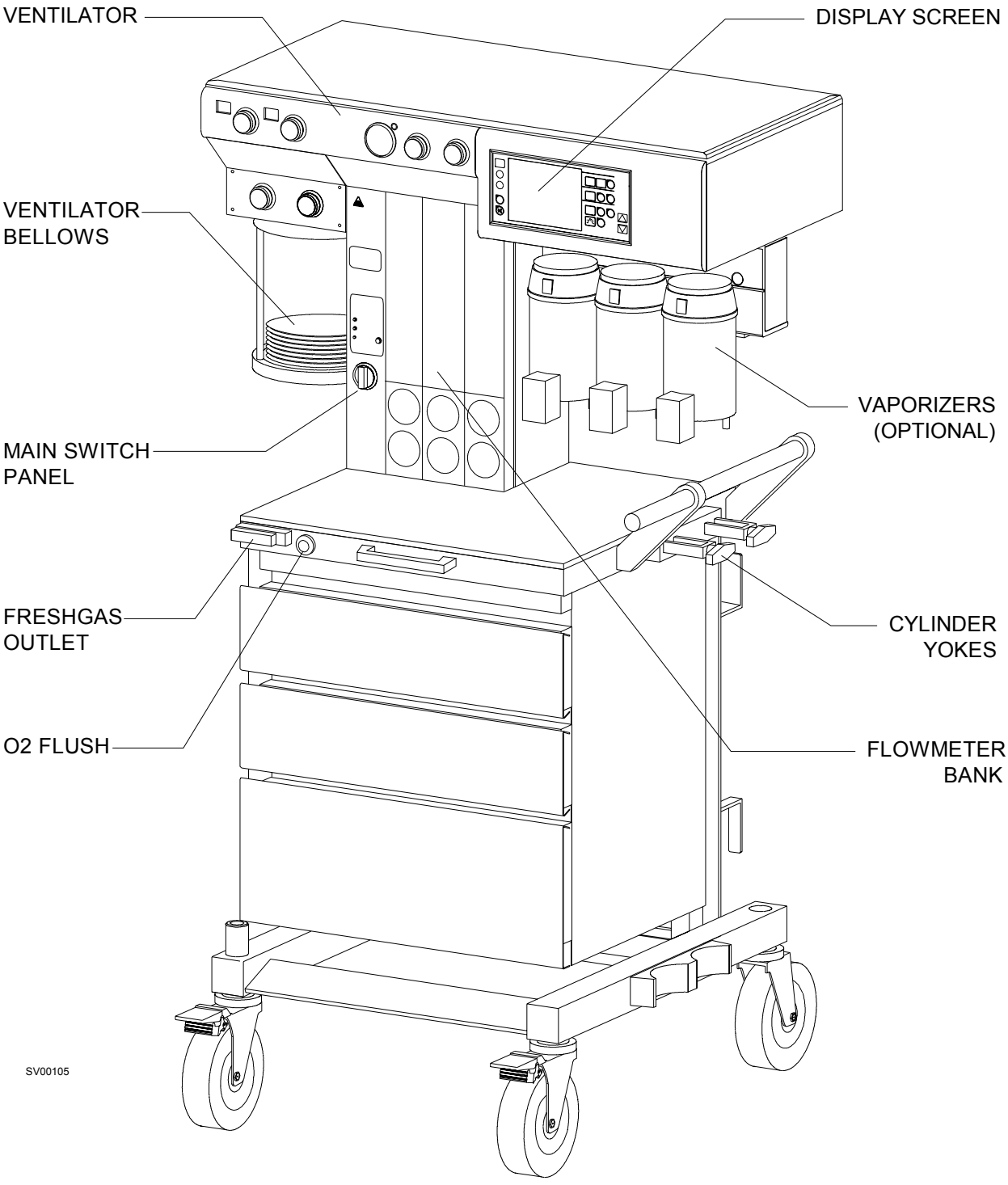
NARKOMED GS ANESTHESIA SYSTEM



1.0 Recommendations

Because of the sophisticated nature of Draeger Medical, Inc. anesthesia equipment and its critical importance in the operating room setting, it is highly recommended that only appropriately trained and experienced professionals be permitted to service and maintain this equipment. Please contact DrägerService℠ at (800) 543-5047 for service of this equipment.

Draeger Medical, Inc. also recommends that its anesthesia equipment be serviced at three-month intervals. Periodic Manufacturer's Service Agreements are available for equipment manufactured by Draeger Medical, Inc. For further information concerning these agreements, please contact us at (800) 543-5047.

Draeger Medical, Inc. products/material in need of factory repair shall be sent to:

DrägerService
3124 Commerce Drive
Telford, PA 18969
(Include RMA Number)

HOW TO USE THIS MANUAL

The manual is divided into several sections. The DIAGNOSTICS section describes self-test and service diagnostics for checking the system functions. An understanding of the on-board service capabilities is necessary before any attempt is made to troubleshoot the unit. The TROUBLESHOOTING section lists error codes and provides troubleshooting guides to assist the Technical Service Representative in locating the source of a problem. The REPLACEMENT PROCEDURES section contains instructions for removal and replacement of assemblies that are considered field-replaceable. The ADJUSTMENT AND CALIBRATION PROCEDURES section contains the field procedures needed to restore original system specifications. The Periodic Manufacturer's Certification (PMC) PROCEDURE section outlines the steps required to verify the electrical, mechanical and pneumatic safety of the unit and also identifies components requiring periodic replacement.

GENERAL TROUBLESHOOTING GUIDELINES

Troubleshooting the Narkomed GS should always begin by communicating with those who observed or experienced a problem with the unit. This may eliminate unnecessary troubleshooting steps. Once a general problem is identified, refer to the troubleshooting flow charts in Section 3 to determine the proper corrective action to be taken.

After any component is replaced, verify that the unit is operating properly by running the appropriate diagnostic procedure. The PMC PROCEDURE in Section 6 must also be performed after any component is replaced.

The general arrangement of the Narkomed GS anesthesia system is shown on the opposite page.

WARNINGS

Warnings are used in this manual before procedures which if not performed correctly could result in personal injury.

CAUTIONS

Cautions are used in this manual to alert service personnel to the possibility of damage to the equipment if a procedure is not performed correctly.

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2.0 DIAGNOSTICS

The Narkomed GS contains a diagnostic system that monitors certain system functions and records their operational status. Following a brief System Startup display at power up, the diagnostics screen shown in Figure 2-1 appears. This display includes one of three messages at the completion of the diagnostics:

FUNCTIONAL: This message indicates that the NARKOMED GS has passed all power-up tests and is fully functional. The machine will proceed to the MACHINE MONITOR screen after a short delay.

CONDITIONALLY FUNCTIONAL: This message indicates that a minor problem has been detected. The NARKOMED GS will retain this display until any key is pressed, then the MACHINE MONITOR screen will be displayed.

NON-FUNCTIONAL: This message indicates that a serious problem has been detected. The machine will not proceed into the MACHINE MONITOR or SYSTEM MONITOR screen.

The PREVENTIVE MAINTENANCE DUE message will appear on the screen if the current date exceeds the Periodic Manufacturer's Service due date stored in the machine.

Further diagnostic functions are available through service screens that can be called up at the display panel. The following paragraphs provide a description of each service screen that can be accessed at the display. If no display is present upon system power-up, refer to Section 3 of this manual for troubleshooting assistance.

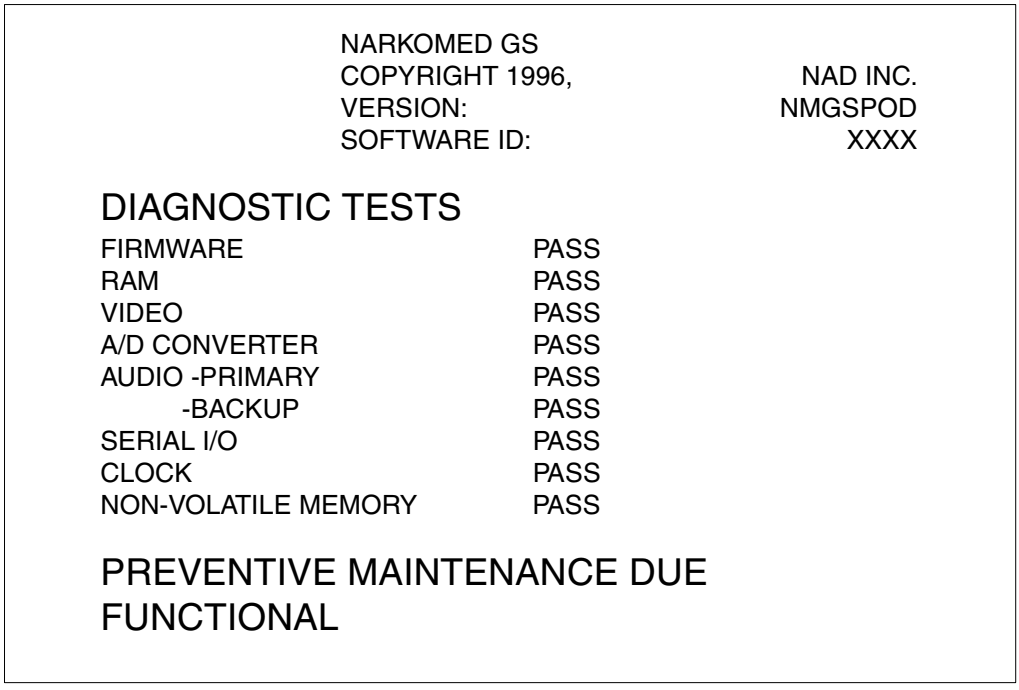

Figure 2-1. Power-up Diagnostics Screen

2.1 Main Service Screen

2.1.1 View Mode

The Main Service Screen displays the machine serial number, the last service date, hours run since last service and total hours run.

To access the Main Service Screen, press and hold the Oxygen High Limit and Volume Low Limit keys, and press the ▲ key. The View Mode service screen shown in Figure 2-2 will then appear.

Press the ▲ key to proceed to the Service Mode (described in the next paragaph), or press the key next to EXIT to return to the monitoring screen.

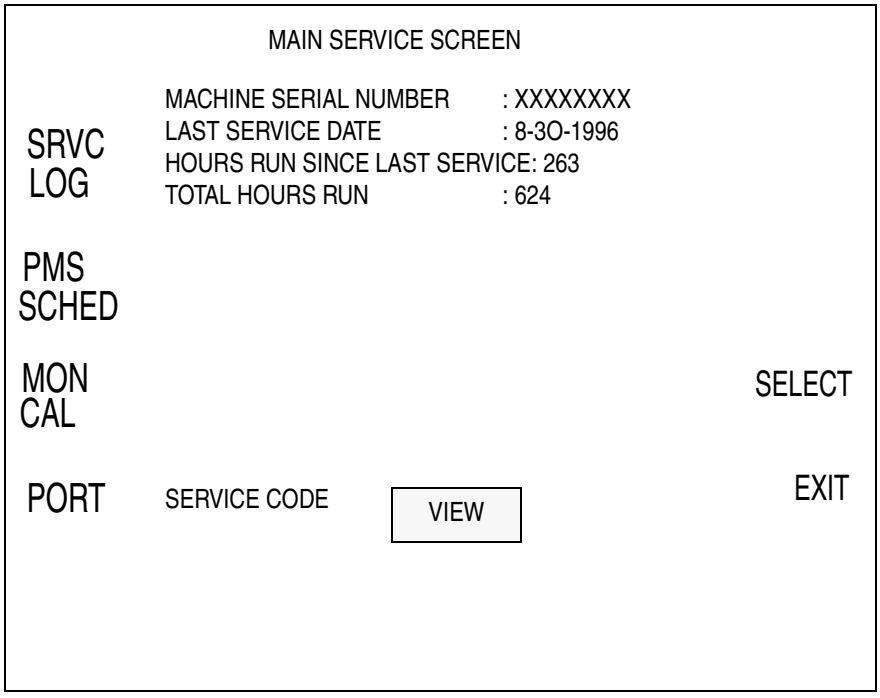

Figure 2-2. Main Service Screen, View Mode

2.1.2 Service Mode

In this screen, the Service Code Changes to SRVC.

Press the key next to SELECT to enable the Technical Service ID entry as described on the next page.

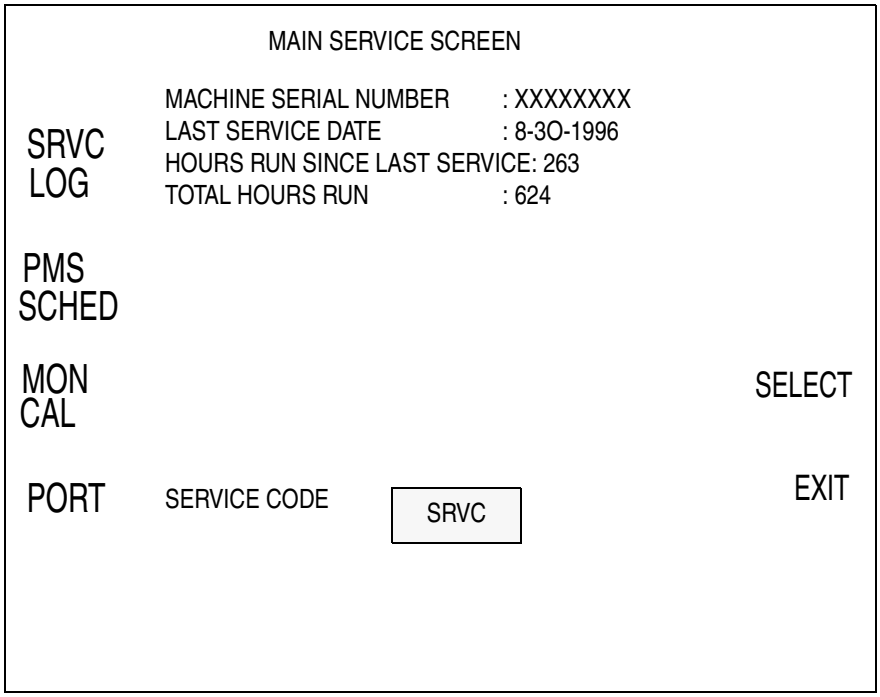

Figure 2-3. Main Service Screen, Service Mode

2.1.3 Service Mode: I.D. Entry

The Service Mode screen appears as shown in Figure 2-4. Press the key next to SELECT. Enter the first digit of your service code by using the ▲ and ▼ keys to display the desired character. Press the key next to SELECT to advance to the next digit, and enter the next and remaining I.D. characters in the same manner.

When this screen is entered, an entry is made in the Service Log.

To access any of the other service screens described on the following pages, press the key next to the desired function on the left side of the screen: Service Log, PMS Schedule, Monitor Calibration, or Port communication settings.

Pressing the key next to RESET will reset the HOURS RUN SINCE LAST SERVICE to zero, and the LAST SERVICE DATE to the current date.

If desired, press the key next to EXIT to return to the monitoring screen.

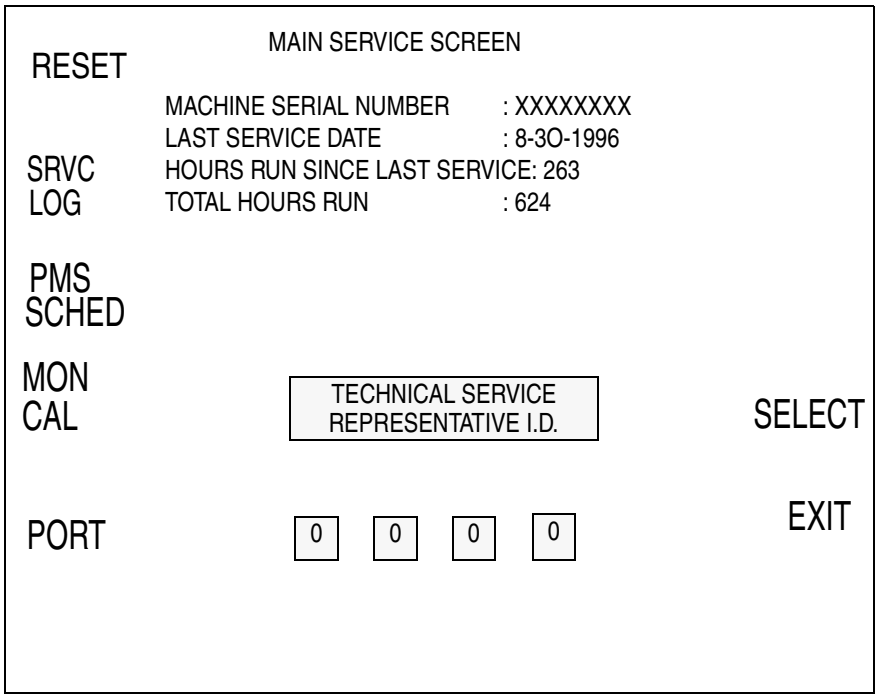

Figure 2-4. Main Service Screen, Service Mode

2.2 Service Log

From the Service Screen (described earlier), press the key next to SRVC LOG.

Figure 2-5 shows an example of the screen that will appear. This screen allows you to view the events recorded in the machine's service log. Use the ▼ and ▲ keys to scroll down or up through the log entries.

Press the key next to EXIT to return to the Main Service Screen.

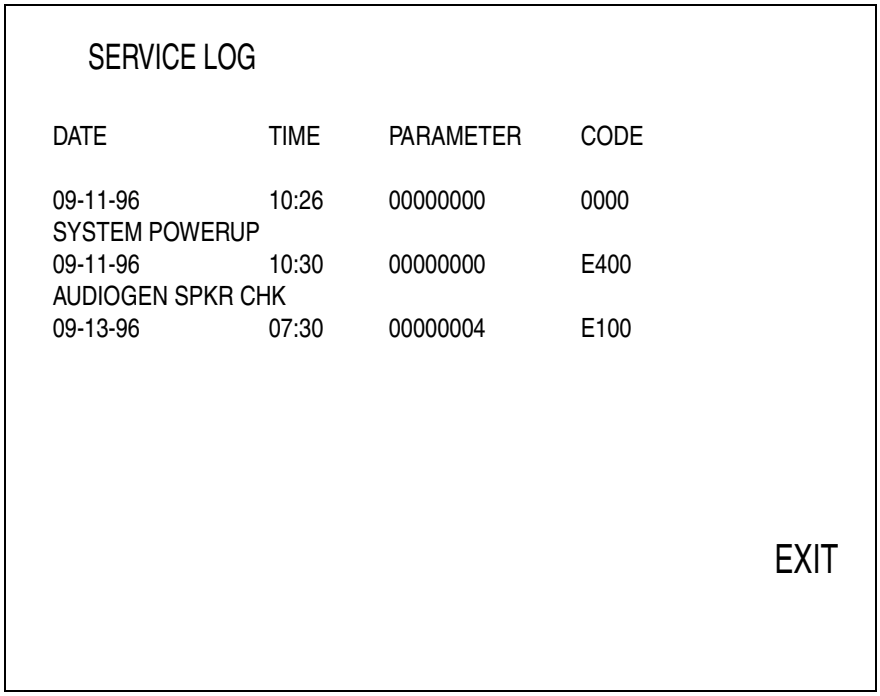

Figure 2-5. Service Log

2.3 PMS Criteria Screen

The PMS Criteria Screen allows you to select the month when the PREVENTIVE MAINTENANCE DUE message appears on the power-up diagnostics screen.

From the Service Screen (described earlier), press the hidden key next to PMS SCHED.

Figure 2-6 shows an example of the screen that will appear. Use the ▲ and ▼ keys to set the desired month.

Press the key next to EXIT to return to the Main Service Screen.

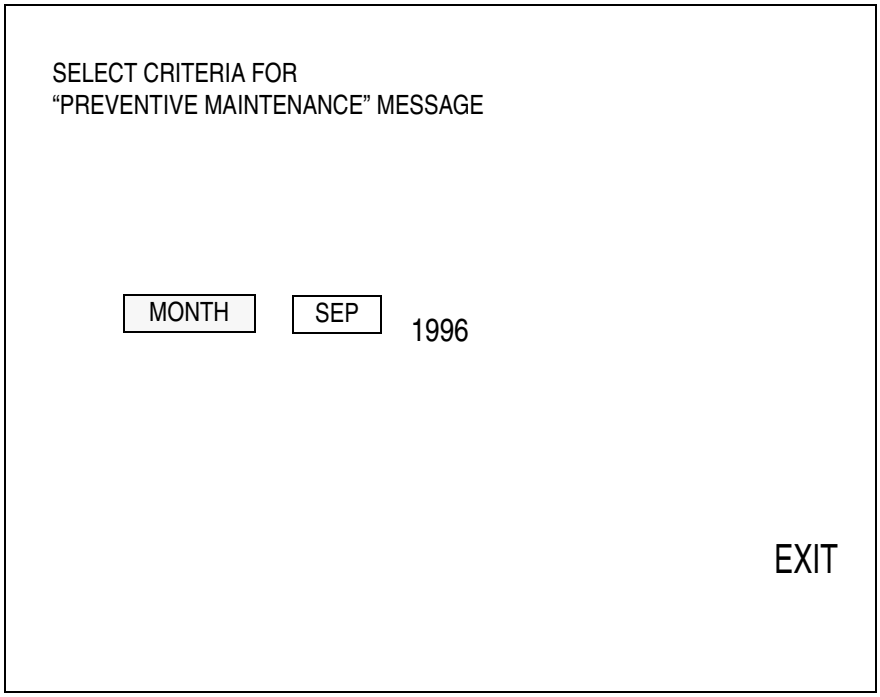

Figure 2-6. PMS Criteria Screen

2.4 Oxygen Monitor Service Screen

The Oxygen Monitor Service Screen shown in Figure 2-7 displays current readings for the O_2 cells, a zero calibration procedure, and the stored calibration values.

From the Service Screen (described earlier), press the key next to MON CAL.

To perform a zero calibration, follow the calibration procedure shown on the screen. Pressing the key next to ZERO stores the current values as the new zero calibration.

To proceed to the Pressure Monitor Service Screen, press the key next to PRES MON. To return to the Main Service Screen, press the key next to EXIT.

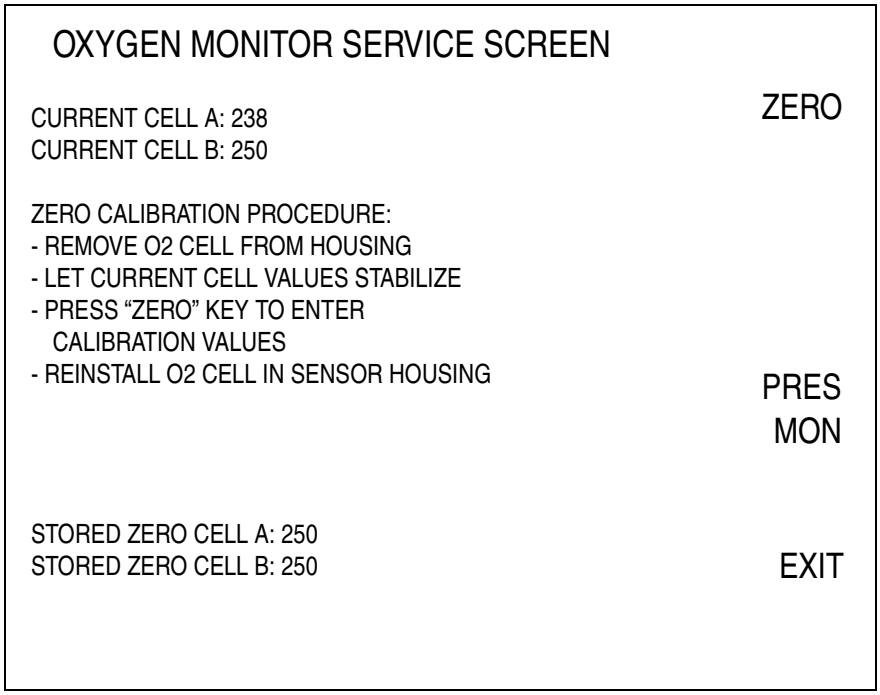

Figure 2-7. Oxygen Monitor Service Screen

2.5 Pressure Monitor Service Screen

The Pressure Monitor Service Screen shown in Figure 2-8 displays the current reading for airway pressure, a procedure for zero and span calibration, and the stored calibration values.

To enter the Pressure Monitor Service Screen from the Oxygen Monitor Service Screen (described earlier), press the key next to PRES MON (ref. Figure 2-6).

To perform a zero calibration, follow the procedure shown on the screen. Pressing the key next to ZERO stores the current value as the new zero calibration.

To perform a span calibration, follow the procedure shown on the screen. Pressing the key next to SPAN stores the current value as the new span calibration.

To return to the Oxygen Monitor Service Screen, press the key next to OXY MON. To return to the Main Service Screen, press the key next to EXIT.

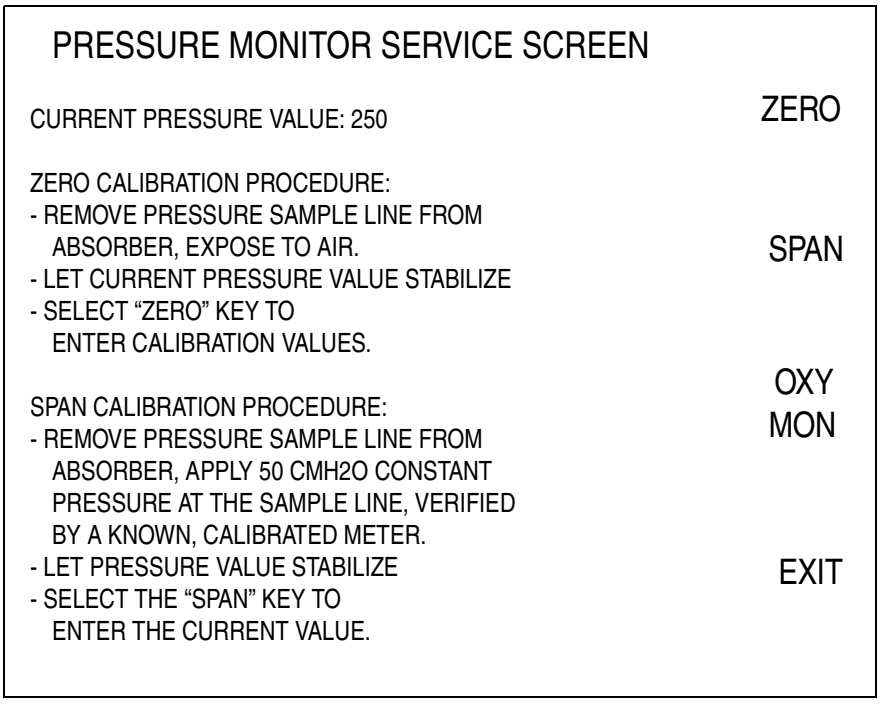

Figure 2-8. Pressure Monitor Service Screen

2.6 Serial Port Configuration Screen

The Serial Port Configuration screen shown in Figure 2-9 allows you to set the machine parameters for communicating with external devices.

From the Service Screen (described earlier), press the key next to PORT.

Use the ▼ and ▲ keys to change the settings; press the key next to SELECT to move to the next setting.

Press the key next to EXIT to return to the Main Service Screen.

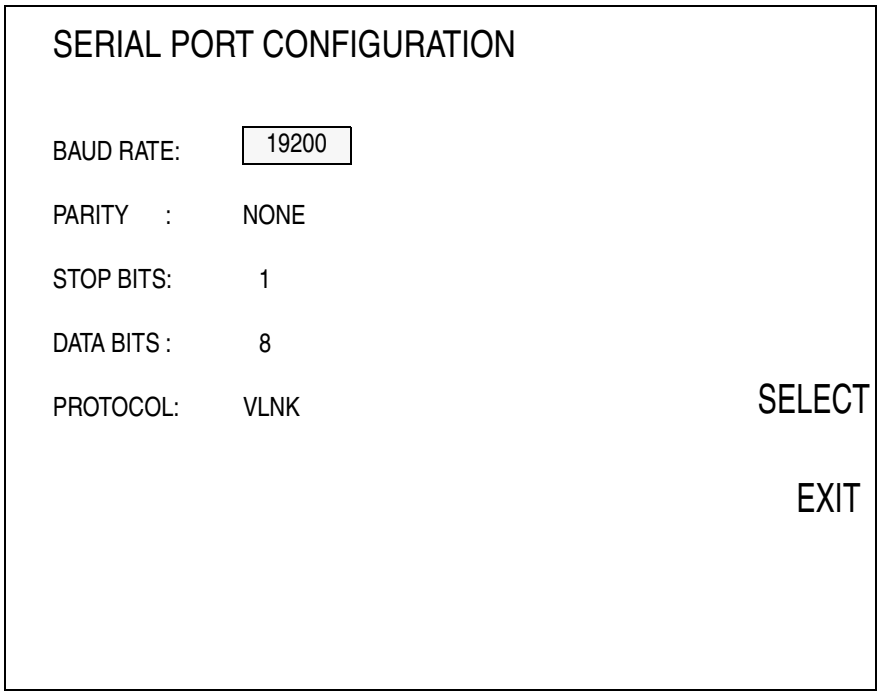

Figure 2-9. Serial Port Configuration Screen

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3.0 TROUBLESHOOTING

This section contains information to assist the Draeger Medical, Inc. qualified Technical Service Representative (TSR) in locating electrical faults affecting the NARKOMED GS monitoring and display devices. Since most troubleshooting efforts begin with verifying power supply voltages, the following paragraph outlines the voltage distribution scheme within the machine along with test points for each of the voltages.

3.1 Power Supply and Voltage Distribution

In the NARKOMED GS, +5VDC, +12VDC and -12VDC are supplied to J14 on the processor board; +8VDC is supplied to J4 on the alarm channel and is also distributed to the ventilator controller via J3 on the alarm channel. These voltages can be measured at the connectors shown in Figure 3-1. Output voltage of the primary power supply is measured at J3 on the Condor supply. Table 3-1 lists the acceptable range for each voltage under normal load conditions. Figure 3-2 shows a block diagram of the NARKOMED GS, including the primary and secondary voltage distribution scheme.

Table 3-1: Test Points and Allowable Ranges

PROCESSOR	VOLTAGE	ACCEPTABLE RANGE
J14-10 (Blk)	+ 5 VDC	4.80 to 5.25 VDC
J14-4 (Blu)	+ 12 VDC	11.65 to 12.85 VDC
J14-13 (Red)	- 12 VDC	-11.50 to -13.00 VDC
J14-15 (Brn)	Common	
Lamp J14-1 (Brn)	+ 12 VDC	
Lamp J14-3 (Orn)	Common	
ALARM CHANNEL	VOLTAGE	ACCEPTABLE RANGE
J3-9 (Wht)	+ 8 VDC	7.70 to 8.30 VDC
J3-3 (Orn)	Common	
CONDOR PWR SUPP	VOLTAGE	ACCEPTABLE RANGE
J3-1 (Brn)	+ 15 VDC	14.0 to 16.0 VDC
J3-8 (Wht)	Common	

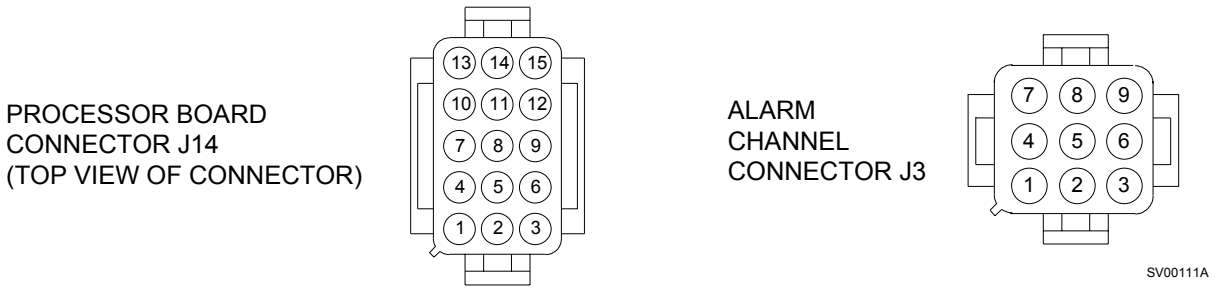


FIGURE 3-1. Power Supply Voltage Test Points

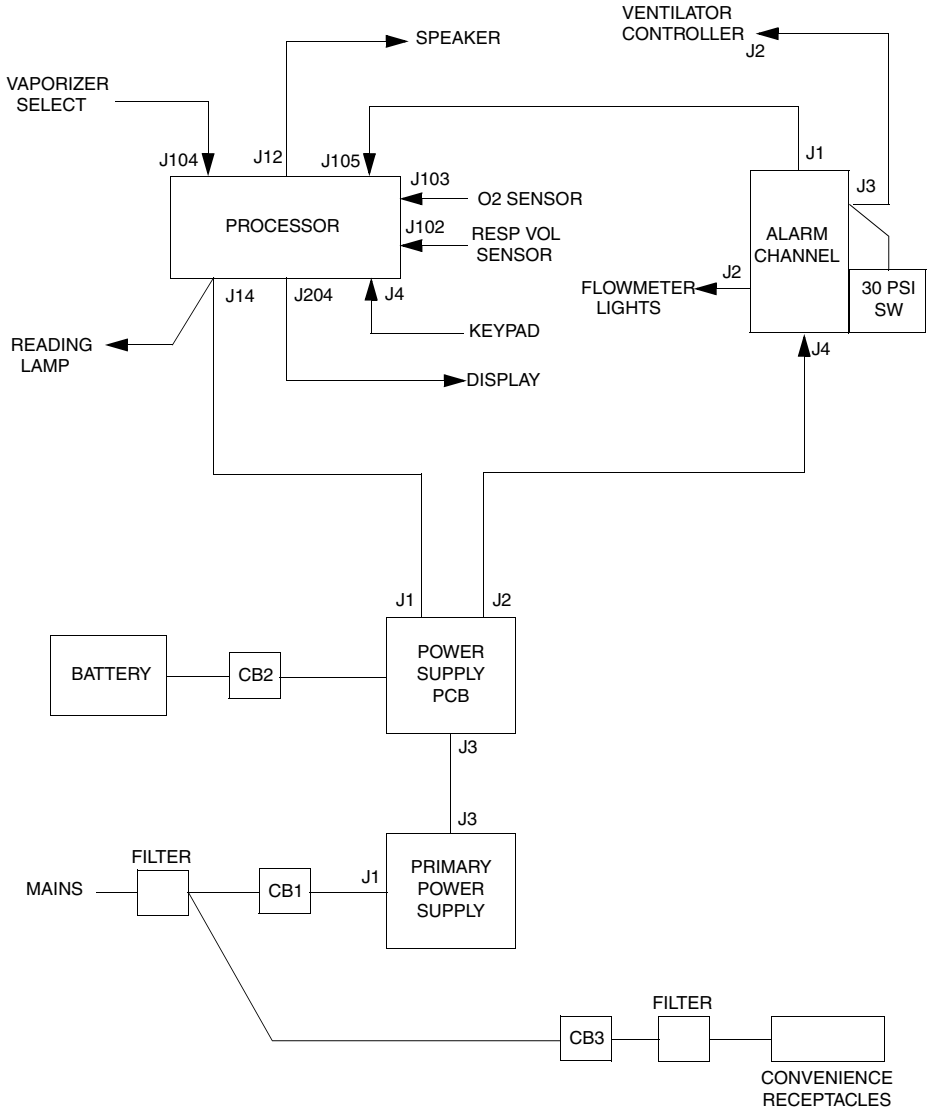


FIGURE 3-2. Narkomed GS Block Diagam (Electrical)

NOTE: The Narkomed GS will not turn on, or operate, unless the power cable is connected to J14 on the processor board. Disconnecting this cable breaks a sense connection that automatically powers down +5V, +12V, -12V, and +8V.

3.2 Battery

While the machine is operating from an AC line, the battery voltage at full charge should be within the range of 13.50 to 14.80 VDC. Battery voltage can be measured at the battery terminals. During battery operation, the low battery cutoff voltage should be within the range of 10.5 to 10.0 VDC.

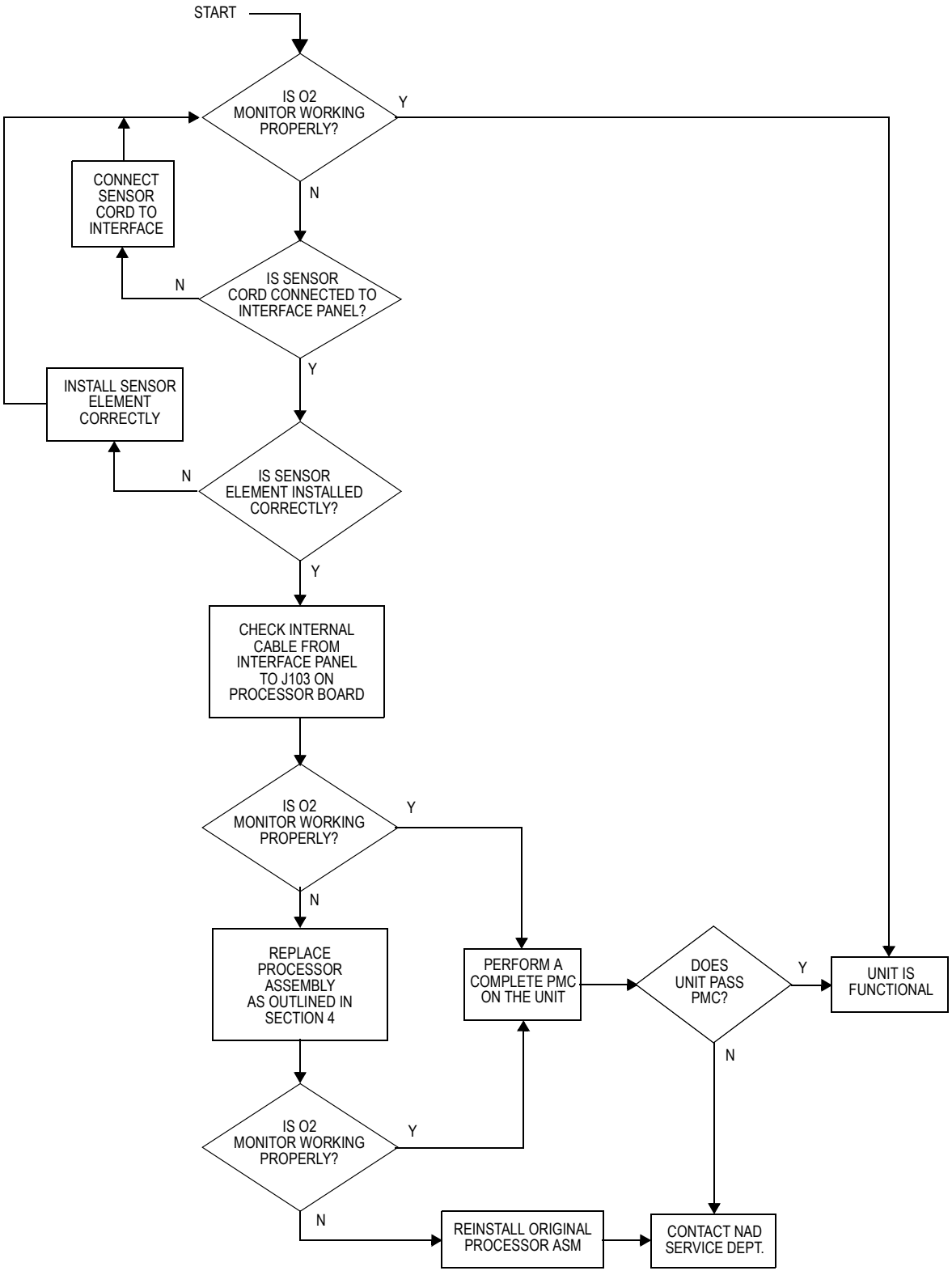
3.3 Troubleshooting Guides

Table 3-2 lists common failure modes and symptoms (excluding simultaneous multiple faults) for the monitoring and display devices in the NARKOMED GS. Each failure mode or symptom is keyed to a troubleshooting guide flow chart at the back of this section to assist the TSR in locating a problem. These flow charts assume that the machine is plugged into an AC outlet with the correct voltage, and the machine is not running on its backup battery.

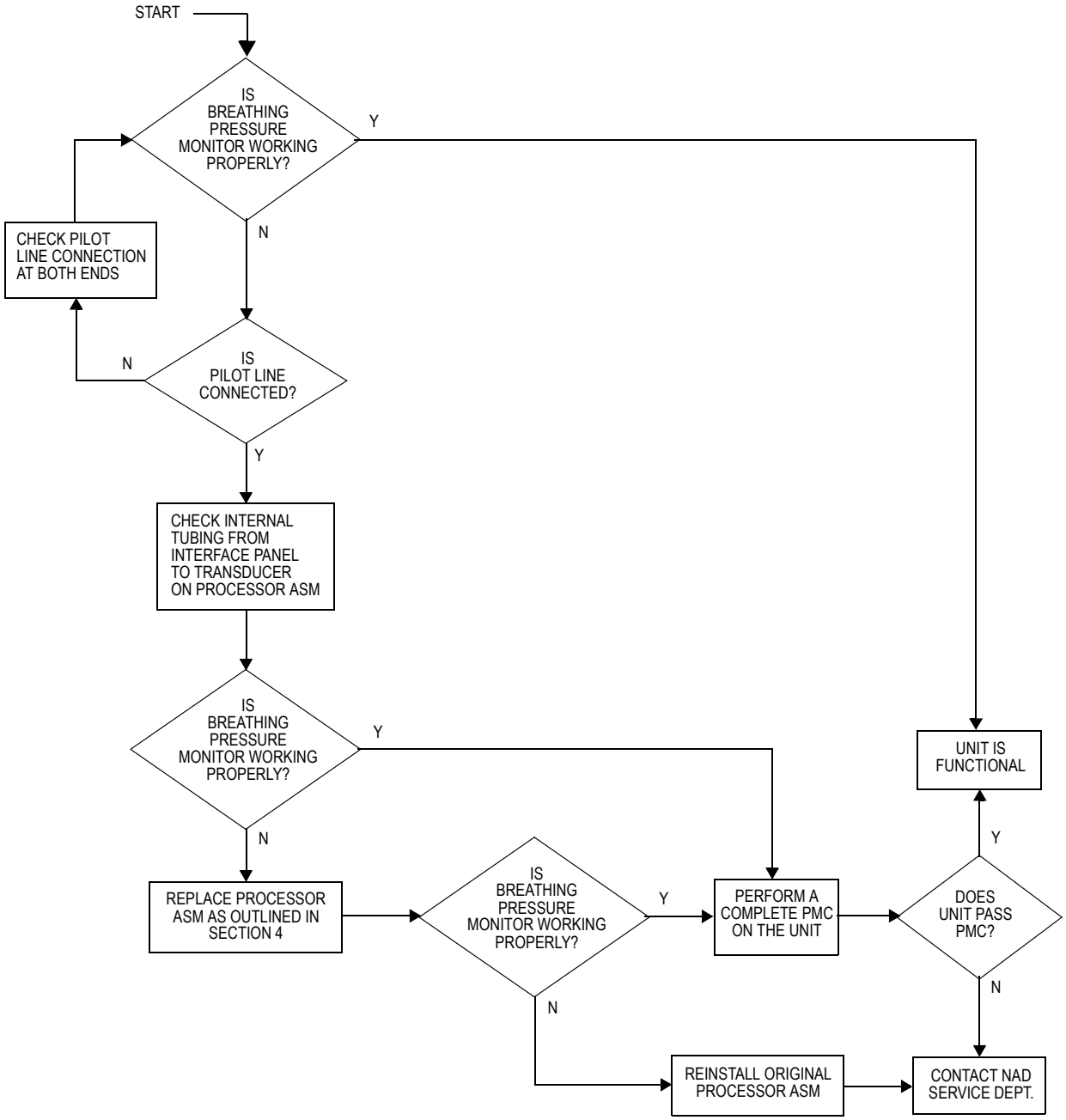
Table 3-2: Narkomed GS Failure Mode and Symptom List

FAILURE MODE / SYMPTOM	CORRECTIVE ACTION
Loss of O2 Monitor	Guide 1
Loss of Breathing Pressure Monitor	Guide 2
Loss of Respiratory Volume Monitor	Guide 3
No Audio Alarms	Guide 4
Serial Port Communication failure	Guide 5
No Oxygen Supply Pressure Alarms	Guide 6
Display Blank Upon System Power-up	Guide 7
Keypad Inoperative	Guide 8
Ventilator Inoperative	Guide 9

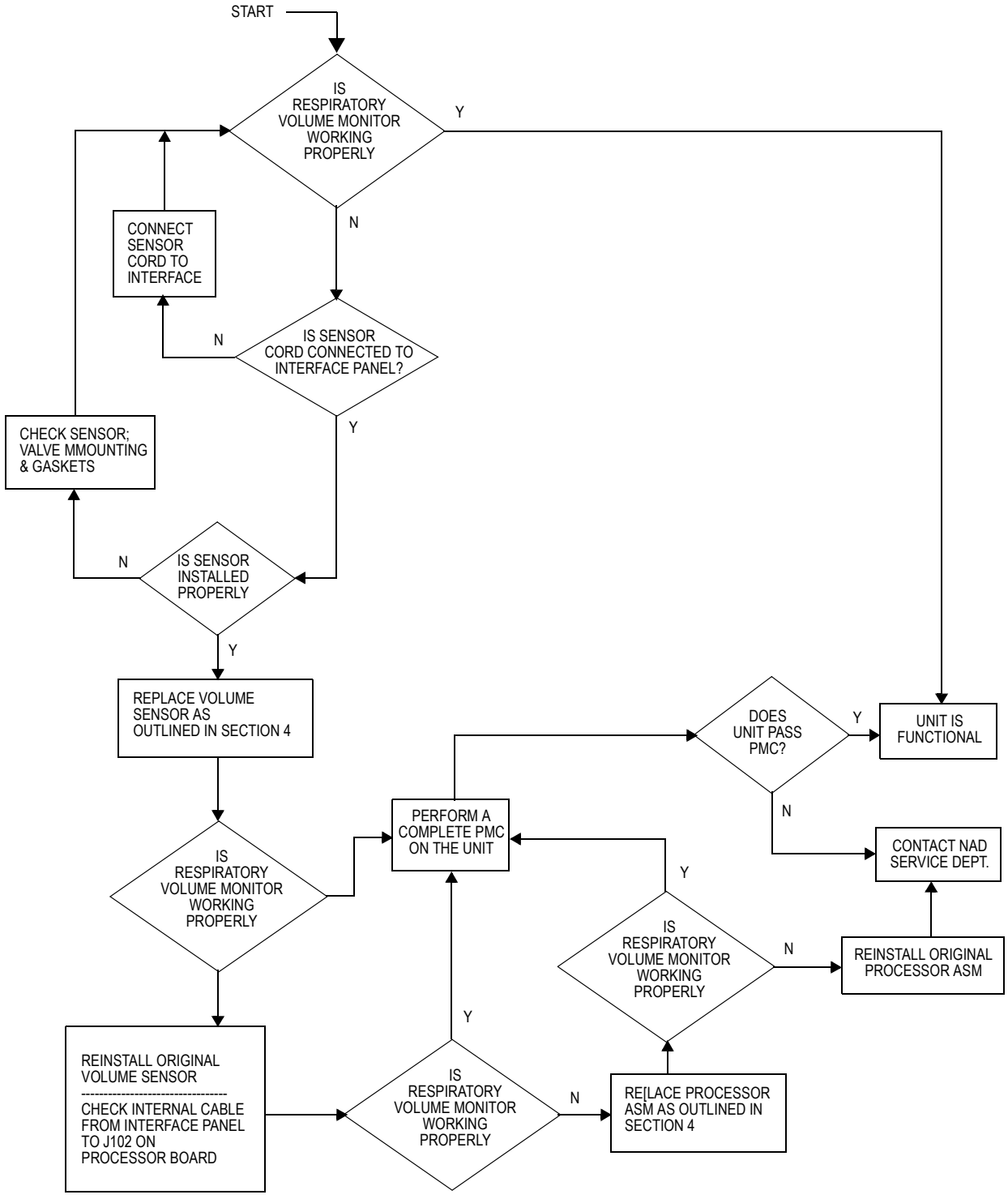
GUIDE 1: Loss of O_2 Monitor



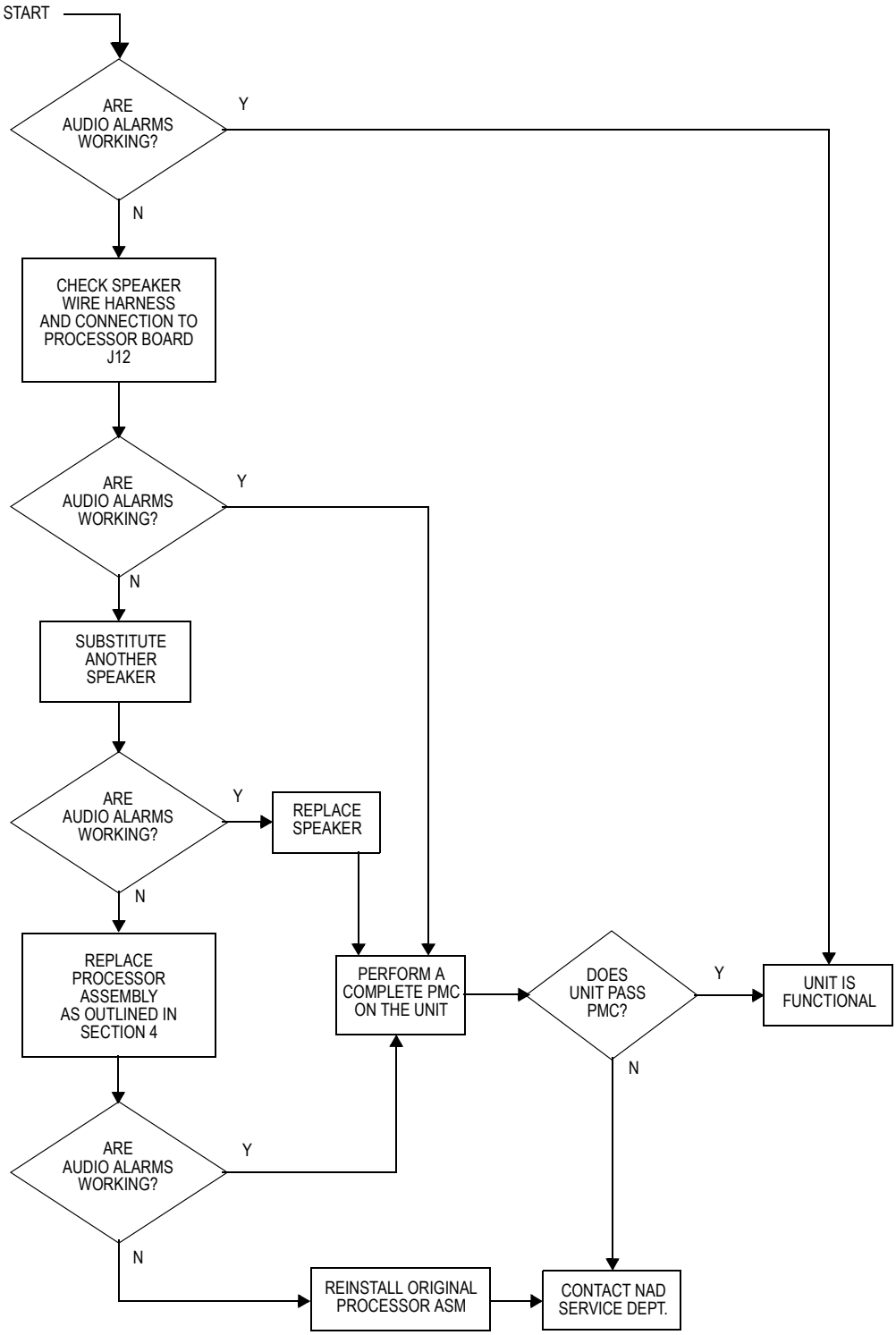
GUIDE 2: Loss of Breathing Pressure Monitor



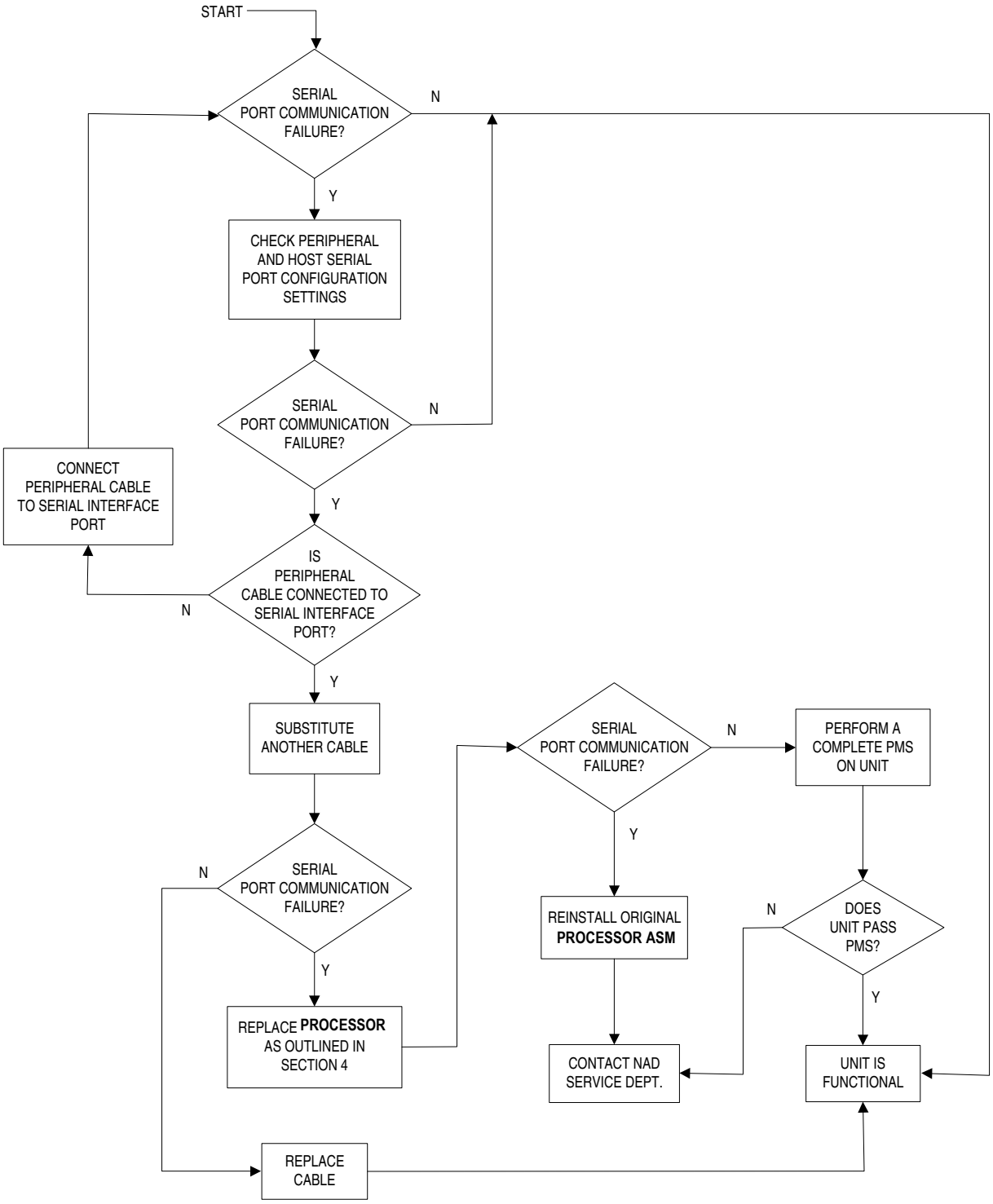
GUIDE 3: Loss of Respiratory Volume Monitor



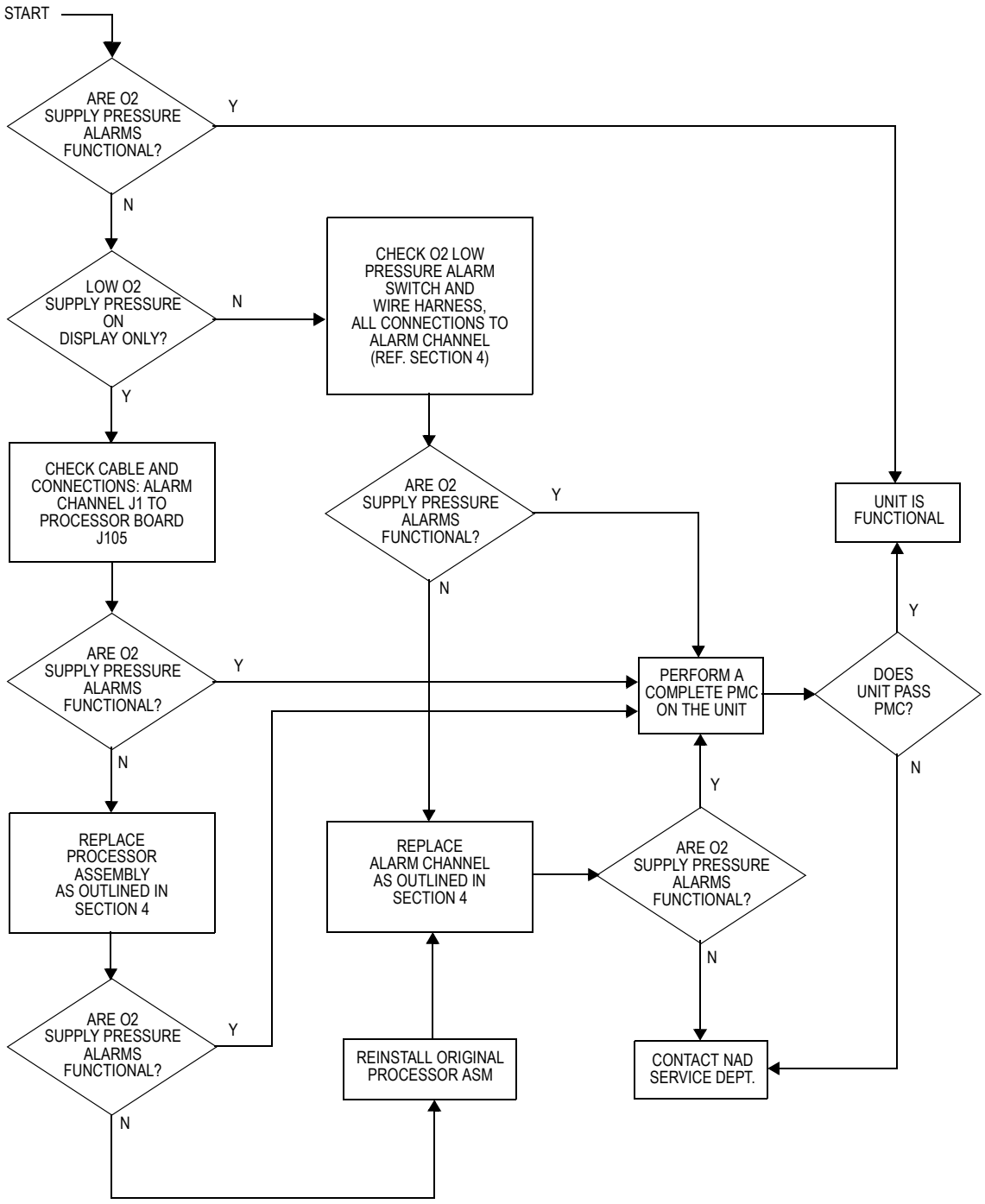
GUIDE 4: No Audio Alarms



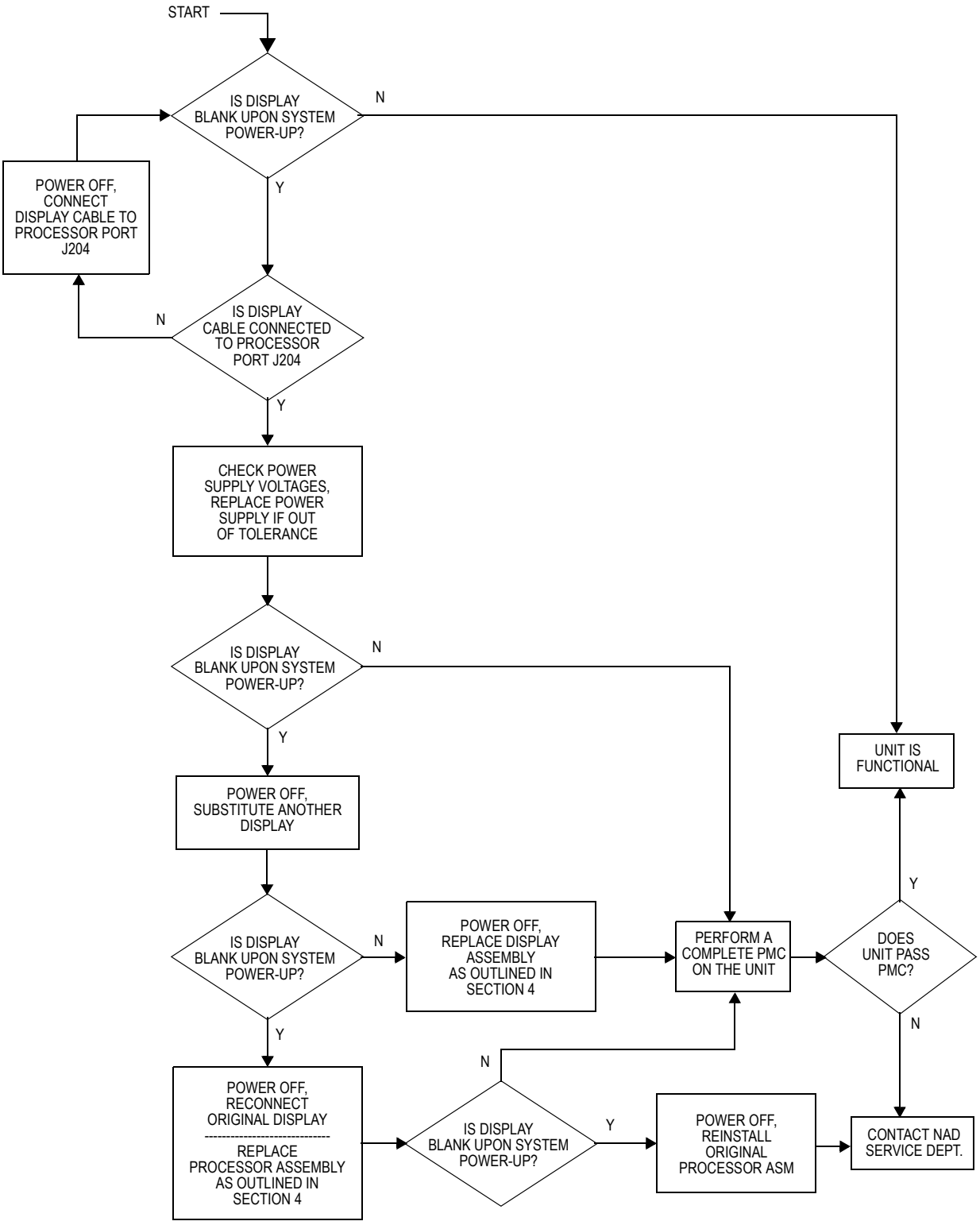
GUIDE 5: Serial Port Communication Failure



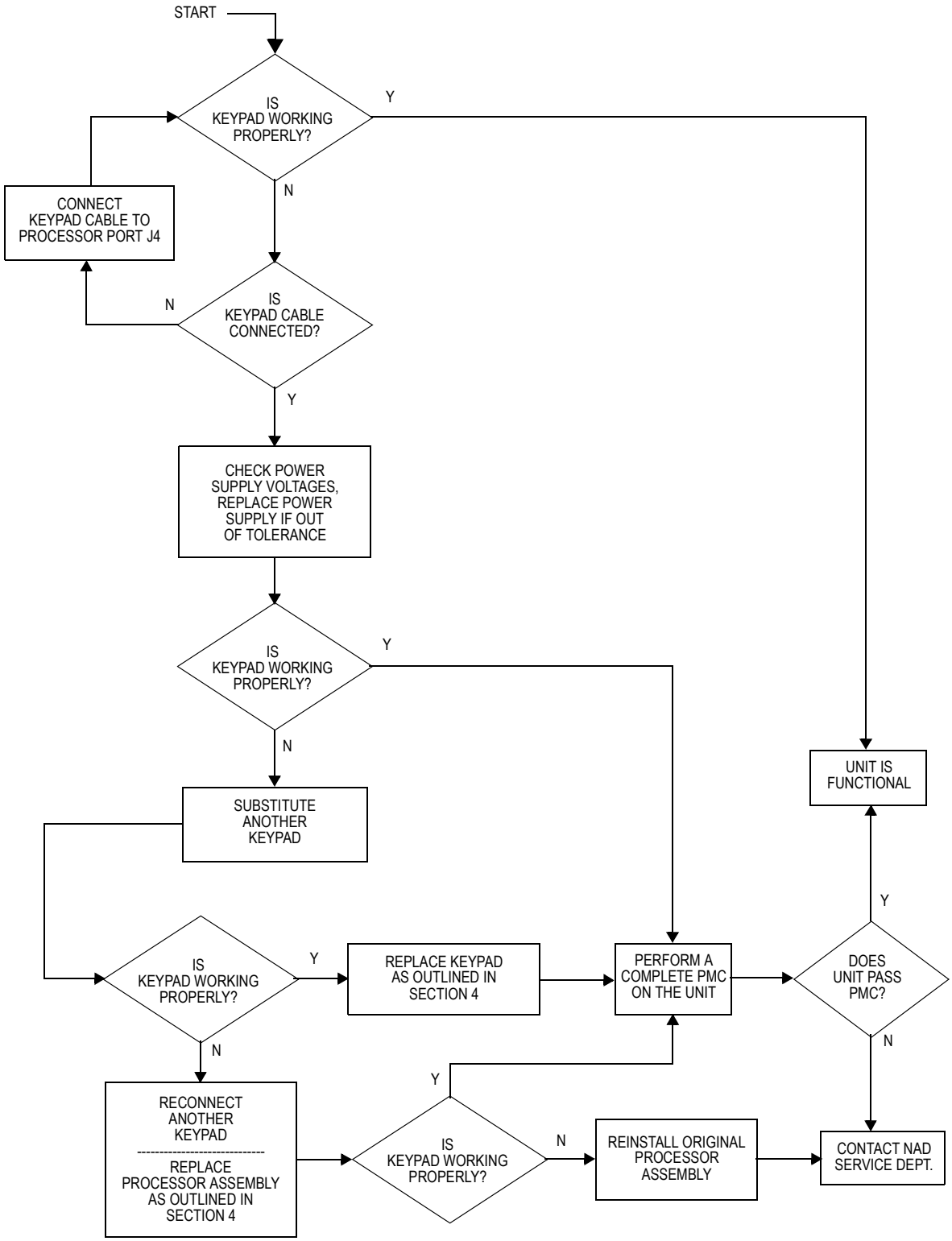
GUIDE 6: No O_2 Supply Pressure Alarms



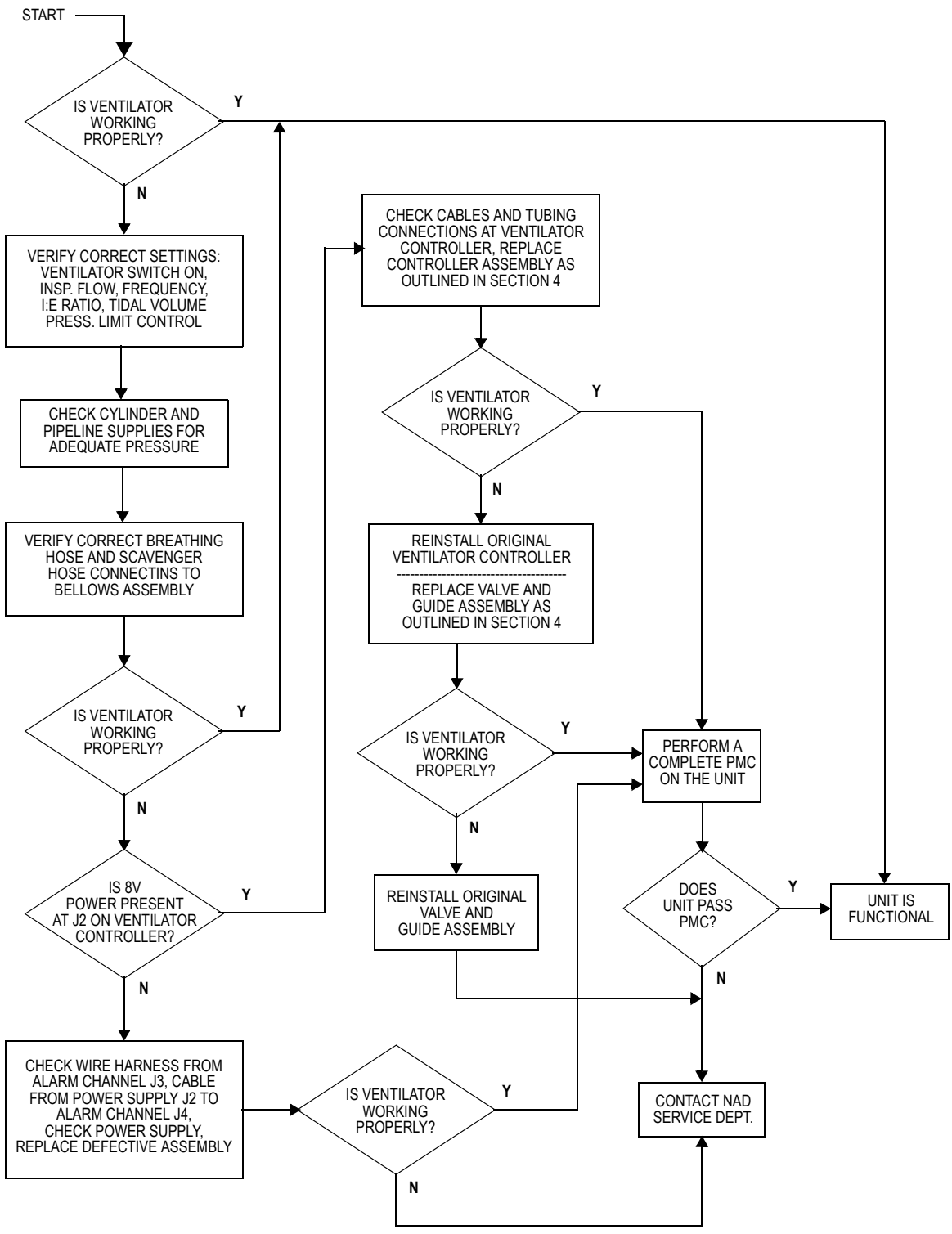
GUIDE 7: Display Blank Upon System Power-up


START
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
N
Y
POWER OFF, CONNECT DISPLAY CABLE TO PROCESSOR PORT J204
IS DISPLAY CABLE CONNECTED TO PROCESSOR PORT J204
N
Y
CHECK POWER SUPPLY VOLTAGES, REPLACE POWER SUPPLY IF OUT OF TOLERANCE
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
N
Y
POWER OFF, SUBSTITUTE ANOTHER DISPLAY
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
N
POWER OFF, REPLACE DISPLAY ASSEMBLY AS OUTLINED IN SECTION 4
Y
POWER OFF, RECONNECT ORIGINAL DISPLAY
REPLACE PROCESSOR ASSEMBLY AS OUTLINED IN SECTION 4
IS DISPLAY BLANK UPON SYSTEM POWER-UP?
N
Y
POWER OFF, REINSTALL ORIGINAL PROCESSOR ASM
CONTACT NAD SERVICE DEPT.
PERFORM A COMPLETE PMC ON THE UNIT
DOES UNIT PASS PMC?
Y
N
UNIT IS FUNCTIONAL

GUIDE 8: Keypad Inoperative



GUIDE 9: Ventilator Inoperative


START
IS VENTILATOR WORKING PROPERLY?
Y
N
VERIFY CORRECT SETTINGS: VENTILATOR SWITCH ON, INSP. FLOW, FREQUENCY, I:E RATIO, TIDAL VOLUME PRESS. LIMIT CONTROL
CHECK CYLINDER AND PIPELINE SUPPLIES FOR ADEQUATE PRESSURE
VERIFY CORRECT BREATHING HOSE AND SCAVENGER HOSE CONNECTINS TO BELLOWS ASSEMBLY
IS VENTILATOR WORKING PROPERLY?
Y
N
IS 8V POWER PRESENT AT J2 ON VENTILATOR CONTROLLER?
Y
N
CHECK WIRE HARNESS FROM ALARM CHANNEL J3, CABLE FROM POWER SUPPLY J2 TO ALARM CHANNEL J4, CHECK POWER SUPPLY, REPLACE DEFECTIVE ASSEMBLY
IS VENTILATOR WORKING PROPERLY?
Y
N
CHECK CABLES AND TUBING CONNECTIONS AT VENTILATOR CONTROLLER, REPLACE CONTROLLER ASSEMBLY AS OUTLINED IN SECTION 4
IS VENTILATOR WORKING PROPERLY?
Y
N
REINSTALL ORIGINAL VENTILATOR CONTROLLER
REPLACE VALVE AND GUIDE ASSEMBLY AS OUTLINED IN SECTION 4
IS VENTILATOR WORKING PROPERLY?
Y
N
REINSTALL ORIGINAL VALVE AND GUIDE ASSEMBLY
PERFORM A COMPLETE PMC ON THE UNIT
DOES UNIT PASS PMC?
Y
N
UNIT IS FUNCTIONAL
CONTACT NAD SERVICE DEPT.

4.0 REPLACEMENT PROCEDURES

This section outlines removal and replacement procedures for the field-replaceable assemblies of the NARKOMED GS Anesthesia System.

These procedures are to be performed only by a Draeger Medical, Inc. qualified Technical Service Representative (TSR).

The following are the only procedures authorized by DrägerService to be performed in the field. All other service procedures shall be referred to NAD's Technical Service Department.

NOTE: The PMC PROCEDURE given in Section 6 must be performed after any replacement, removal, calibration or adjustment procedure.

4.1 Cylinder Yoke Assemblies

Each cylinder yoke contains a replaceable filter and check valve assembly. Replacement of this assembly requires that the yoke be removed from the anesthesia machine. Figure 4-1 shows a typical cylinder yoke mounting arrangement. Access to the yoke mounting screws and gas line connection requires that the table top be removed from the machine.

4.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.1.2 Close all cylinder valves except the O_2 valve.

4.1.3 Set the oxygen flow to 5 liters per min.

4.1.4 Open the other gas flow control valves to drain pressure from the system.

4.1.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.1.6 Set the System Power switch to STANDBY.

4.1.7 Remove the cylinder where the yoke is to be replaced.

WARNING:Store the cylinder in a safe place and lay it on its side.

4.1.8 Loosen the screws holding the table top to the machine and lift out the table top.

4.1.9 Pull the writing tray out to its fully extended position.

4.1.10 Disconnect the gas line fitting at the yoke and remove the two yoke mounting screws.

4.1.11 Remove the filter and check valve assembly from the yoke and install a replacement assembly.

NOTE: If the entire yoke assembly is being replaced, verify that the pin indexing arrangement and the label are in agreement with the gas designation stamped on the mounting surface of the yoke. Refer to the parts list in Section 8.

NOTE: If the yoke spacer is removed from the frame rail of the machine, be sure to re-install it in its original position.

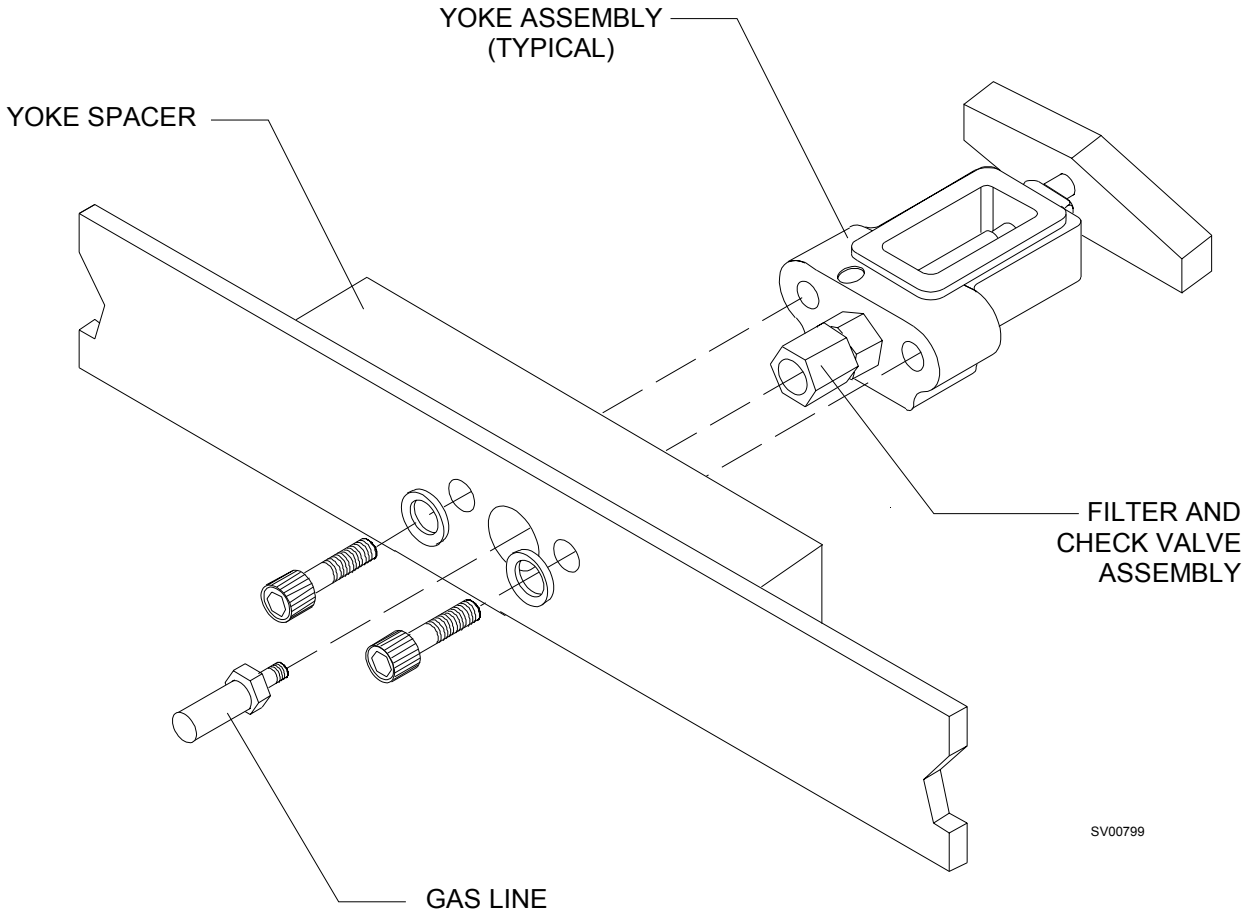


Figure 4-1. Cylinder Yoke Assembly

4.1.12 Position the yoke on the spacer, and install the two mounting screws and lockwashers. Tighten the screws securely. Connect the gas line fitting to the yoke.

4.1.13 If a new cylinder is being installed, remove the old sealing washer from the gas inlet of the yoke and install a new washer.

4.1.14 Install the correct cylinder in the yoke, making sure that the index pins are properly engaged before tightening the handle bolt. The cylinder should hang vertically after the handle is tight.

4.1.15 Perform the following leak test on the yoke assembly:

4.1.16 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 Psi

N_2O : 700 Psi

HE : 1000 Psi

CO_2 : 800 Psi

AIR : 1000 Psi

N_2 : 1000 Psi

4.1.16.1 Close the cylinder valve and remove the cylinder from the yoke.

4.1.16.2 For any gas, the pressure should not drop more than 50 Psi in two minutes.

4.1.17 Re-install the cylinder in the yoke.

4.1.18 Reinstall the table top and tighten its retaining screws.

4.1.19 Replace the pipeline hoses.

4.1.20 Perform the PMC Procedure given in Section 6.

4.2 Cylinder Pressure Regulators

Access to the cylinder pressure regulators requires that the table top be removed from the anesthesia machine. Figure 4-2 shows the mounting arrangement of the regulators and typical connections.

4.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.2.2 Close all cylinder valves except the O_2 valve.

4.2.3 Set the oxygen flow to 5 liters per min.

4.2.4 Open the other gas flow control valves to drain pressure from the system.

4.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.2.6 Set the System Power switch to STANDBY.

4.2.7 Remove the cylinder corresponding to the regulator to be replaced.

4.2.8 Loosen the screws holding the table top to the machine and lift out the table top.

4.2.9 Pull the writing tray and the top cabinet drawer out to their fully extended position.

4.2.10 Disconnect the compression fittings at the regulator.

4.2.11 Loosen the two setscrews holding the regulator to its mounting bracket and remove the regulator.

4.2.12 Record the serial number of the regulator that was removed, and record the serial number of the replacement regulator.

NOTE: If fittings must be installed in the replacement regulator, use Loctite #271 (red). Refer to the parts list in Section 8.

NOTE: For Canadian machines, verify that the correct relief valve is installed in the regulator. Refer to the parts list in Section 8 for CSA items.

4.2.13 Position the replacement regulator in its mounting bracket, and connect the three compression fittings. Do not tighten the fittings yet.

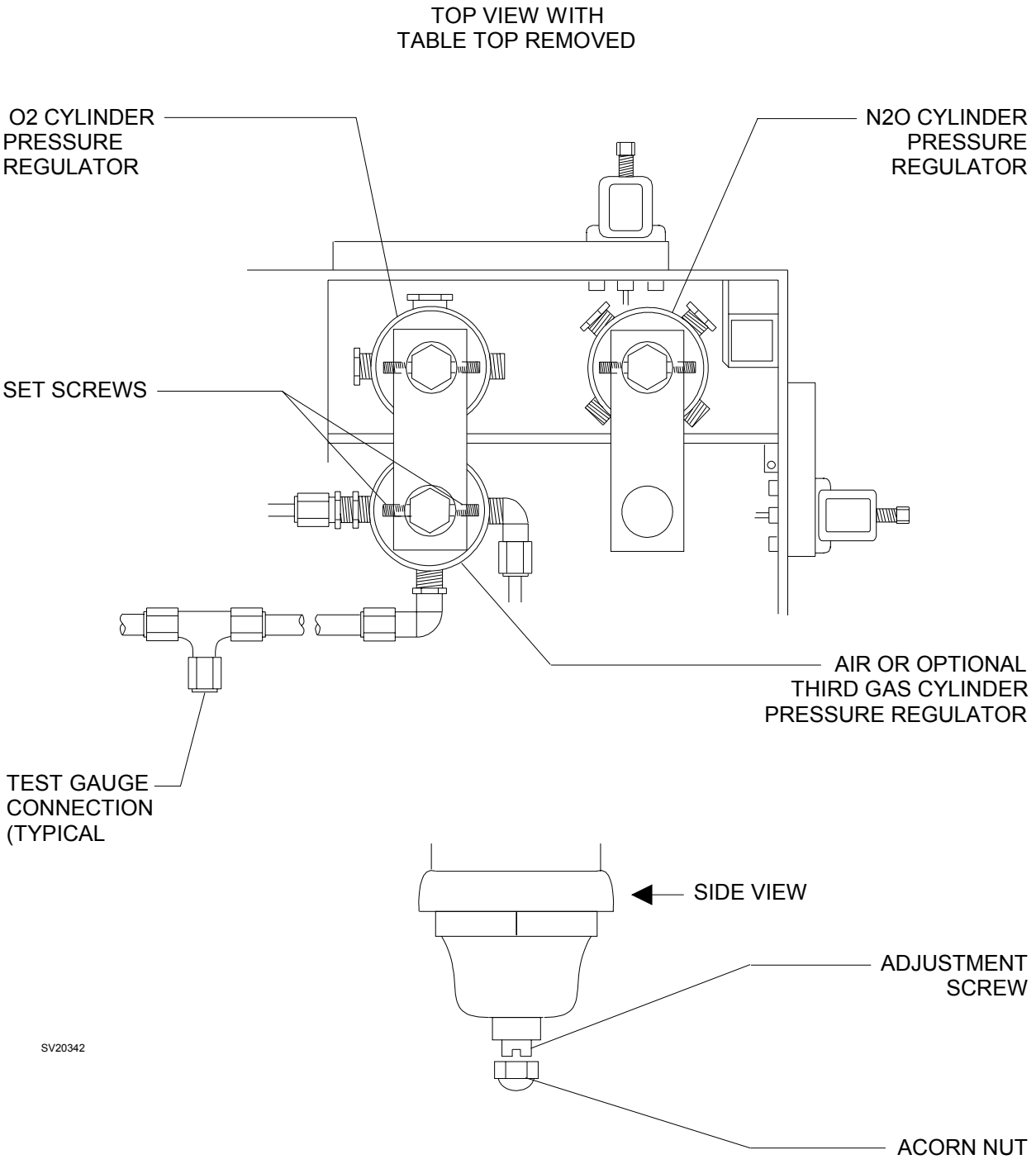


Figure 4-2. Cylinder Pressure Regulators

4.2.14 Tighten the regulator mounting setscrews to a torque of 50 to 55 in. lbs.

4.2.15 Tighten the compression fittings.

4.2.16 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

4.2.17 Set the regulator output pressure in accordance with the Cylinder Pressure Regulator Adjustment given in Section 5.

4.2.18 Perform the following leak test on the high pressure side of the regulator:

4.2.18.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2 : 1000 Psi
N_2O : 700 Psi
HE : 1000 Psi
CO_2 : 800 Psi
AIR : 1000 Psi
N_2 : 1000 Psi

4.2.18.2 Close the cylinder valve and remove the cylinder from the yoke.

4.2.18.3 For any gas, the pressure should not drop more than 50 Psi in two minutes.

4.2.19 Re-install the cylinder in the yoke.

4.2.20 Reinstall the table top and tighten its retaining screws.

4.2.21 Connect the pipeline hoses.

4.2.22 Perform the PMC Procedure given in Section 6.

4.3 Cylinder Cutoff Valves (Canada)

Access to the cylinder cutoff valves requires removal of the table top from the anesthesia machine. Figure 4-3 shows typical locations of the O_2, Air or 3rd gas, and N_2O cutoff valve assemblies. The instructions apply to all three assemblies.

NOTE: Replacement of the O_2 Cutoff Valve Assembly shall be performed every 24 months. Documentation shall be created by the service person and a copy distributed to the owner institution. Testing of the O_2 Cutoff Valve shall be performed at each PMC. (Perform the flow test given at the end of the following procedure)

4.3.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.3.2 Close all cylinder valves except the O_2 valve.

4.3.3 Set the oxygen flow to 5 liters per min.

4.3.4 Open the other gas flow control valves to drain pressure from the system.

4.3.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.3.6 Set the System Power switch to STANDBY.

4.3.7 Loosen the screws holding the table top to the machine and lift out the table top.

4.3.8 Pull the writing tray and the top cabinet drawer out to their fully extended position.

4.3.9 Disconnect the compression fittings indicated at points marked C on the illustration.

4.3.10 Disconnect the flexible tubing from the cutoff valve assembly at the point marked A on the illustration.

4.3.11 Remove the cylinder cutoff assembly.

4.3.12 Connect the flexible tubing to the replacement cutoff valve assembly and secure it with the hose clamp.

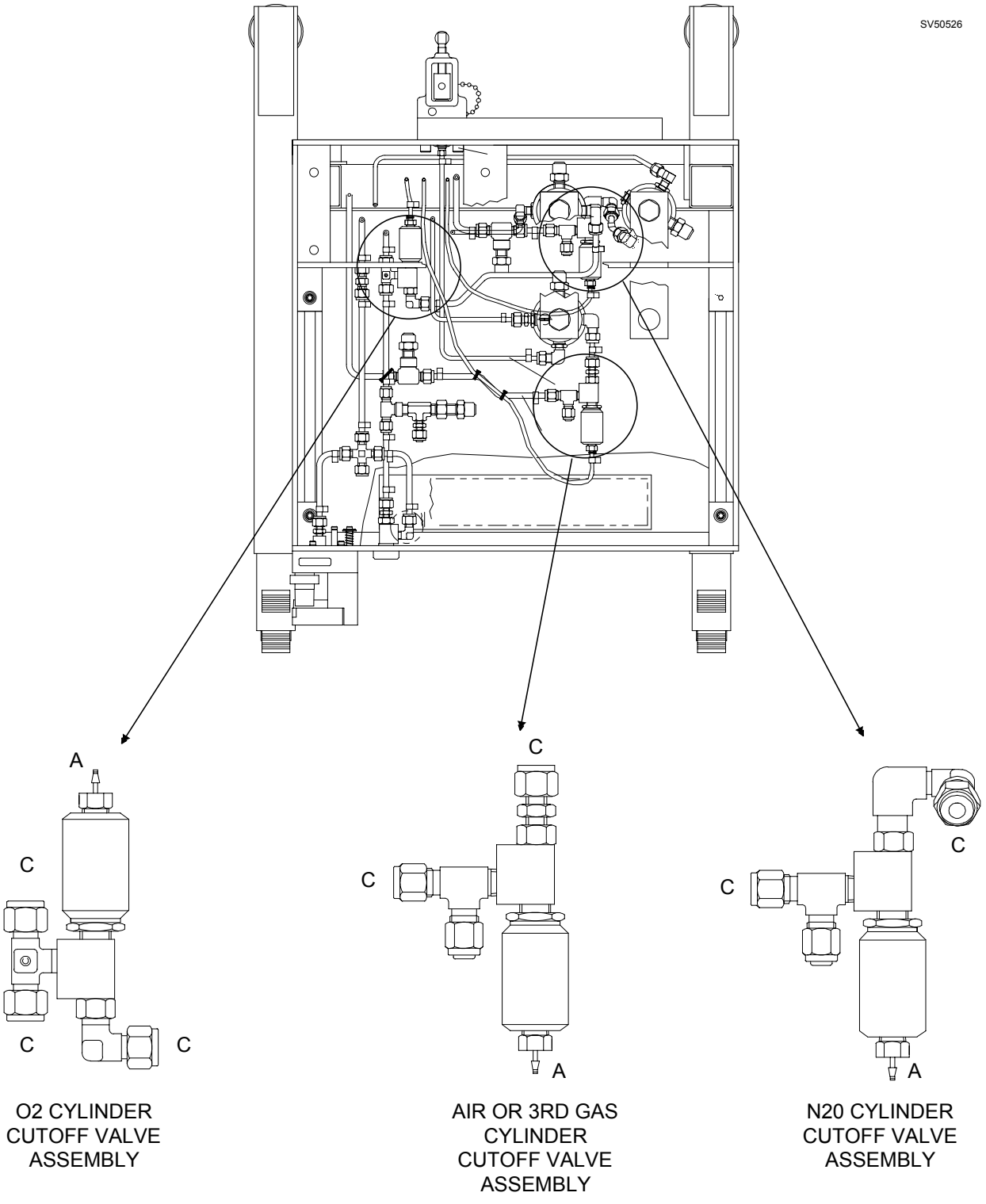


Figure 4-3. Cylinder Cutoff Valves (Canada)

4.3.13 Connect and tighten the compression fittings at points marked C on the illustration.

4.3.14 Perform the following test: --Remove the plug from the test gauge connection at the Tee fitting in the regulator outlet piping, and install a test gauge.

NOTE: The cylinders used for this test must contain the following minimum pressure: O_2: 1000 PSI AIR: 1000 PSI
O_2+He : 1000 PSI N_2O: 745 PSI

--Set the System Power switch to ON.
--For the O_2 cutoff valve: open the O_2 cylinder valve and set the oxygen flow to 4 liters per min.
--For the N_2O cutoff valve: open the O_2 cylinder valve and the N_2O cylinder valve. Set each flow to 4 liters per min.
--Verify that regulator outlet pressure is between 43 and 49 PSI.
--Connect the pipeline hoses and pressurize to 50 PSI.
--Turn off the pipeline supply and observe the pipeline pressure gauge.
--The cutoff valve shall open when the pipeline pressure drops through the range of 45 to 40 PSI.
--Close the cylinder valve(s), and close the flow control valve(s).
--Disconnect test pressure gauge and reinstall the plug in the regulator outlet piping.

4.3.15 Reinstall the table top and tighten its retaining screws.

4.3.16 Connect the pipeline hoses.

4.3.17 Perform the PMC Procedure given in Section 6.

O_2 Flow Test:

--Disconnect all pipeline supplies.
--Install a full O_2 cylinder on the machine, and open the cylinder valve.
--Turn the System Power switch to ON.
--Set the Inspiratory Flow control to maximum high, and turn the ventilator switch to ON.
--Set the oxygen flow to 10 l/min.
--Verify that the oxygen flow does not drop below 8 l/min. while the ventilator is running.
--Press and hold the O_2 FLUSH button while observing the O_2 flowmeter, and verify that the oxygen flow does not drop below 8 l/min.
--If the oxygen flow in either of the above two steps drops below 8 l/min., replace the O_2 cutoff valve assembly.

4.4 Cylinder and Pipeline Pressure Gauges

Replacement of the cylinder and pipeline pressure gauges requires that the plexiglass front cover be removed from the gas instrumentation panel, and also the rear cover for access to the gauge connections. Figure 4-4 shows gauge mounting and connection details.

4.4.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.4.2 Close all cylinder valves except the O_2 valve.

4.4.3 Set the oxygen flow to 5 liters per min.

4.4.4 Open the other gas flow control valves to drain pressure from the system.

4.4.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.4.6 Set the System Power switch to STANDBY.

4.4.7 Remove the screws holding the rear cover, and remove the cover.

4.4.8 Loosen the screws holding the table top to the machine and lift out the table top.

4.4.9 Remove the screws holding the flowmeter shield and vapor box front cover panel, and remove the panel.

4.4.10 Remove the oxygen flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.4.11 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.4.12 Carefully remove the plexiglass cover from the front of the flowmeter housing.

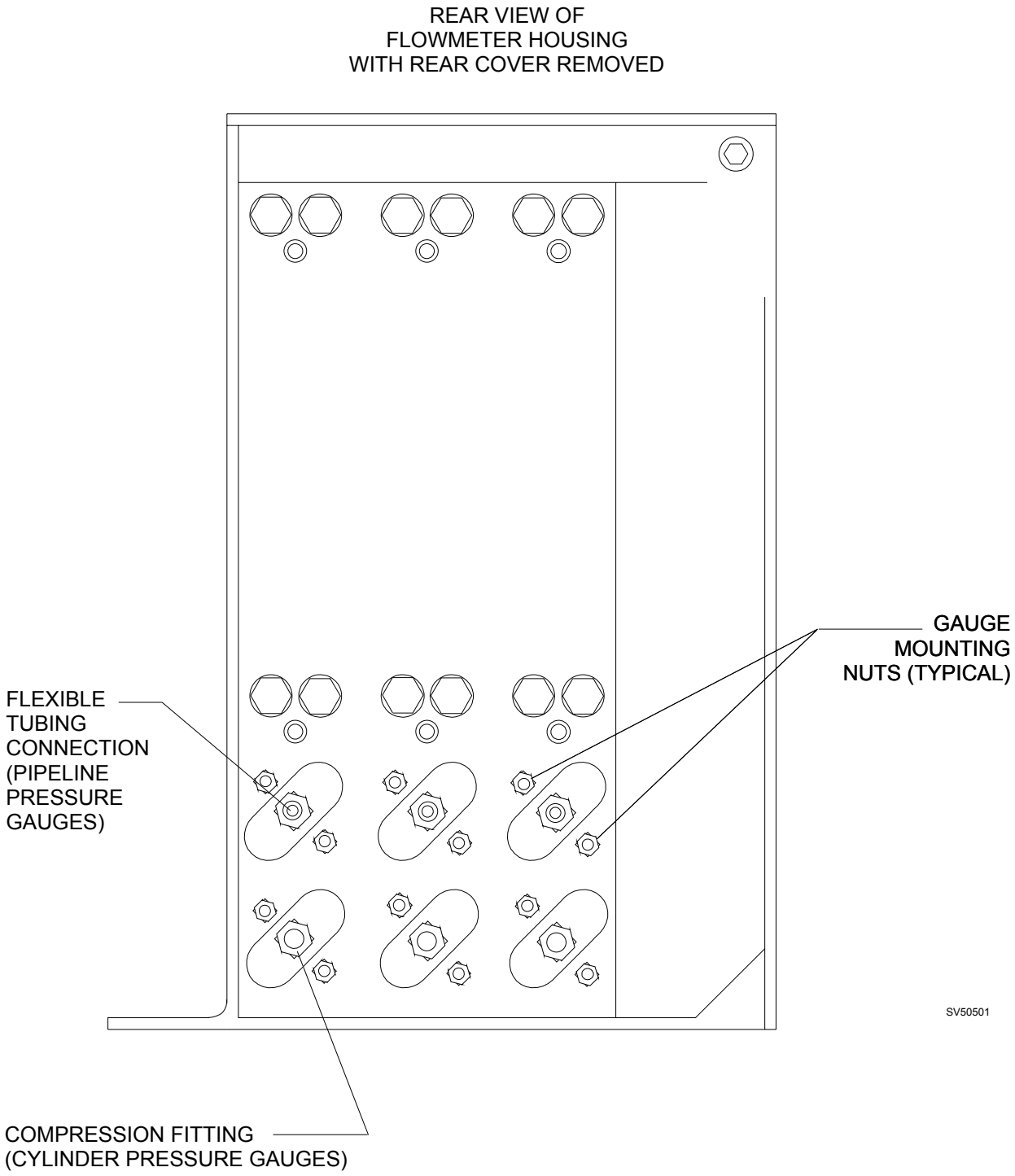


Figure 4-4. Cylinder and Pipeline Pressure Gauges

NOTE: Intermediate assemblies may need to be removed to allow access to the gauge connections and mounting hardware. Be sure to keep a record of the disassembly sequence so that all tubing can be correctly re-assembled.

4.4.13 A: For the cylinder pressure gauges:

Disconnect the compression fitting at the back of the gauge.

Remove the gauge mounting nuts, and remove the gauge from the front of the panel.

Install the replacement gauge in the panel using the flat washers, lock washers and mounting nuts that were previously removed.

Connect the gas line to the gauge and tighten the compression fitting.

4.3.13 B: For the pipeline pressure gauges:

Locate the flexible tubing connecting the gauge to the pipeline inlet assembly and disconnect the tubing.

Remove the gauge mounting nuts, and remove the gauge from the front of the panel.

Disconnect the flexible tubing from the gauge.

Connect a new 7-inch length of tubing (8-inch for the air pipeline pressure gauge) to the replacement gauge and secure it with a hose clamp.

Place the gauge in the panel and secure it with the flat washers, lock washers and mounting nuts that were previously removed.

Place a hose clamp on the other end of the flexible tubing; connect the tubing to the pipeline inlet assembly and secure it with the hose clamp.

4.4.14 If a cylinder pressure gauge was replaced, perform the following leak test:

4.4.14.1 Open the cylinder valve and check for a pressure indication on the corresponding gauge at the gas instrumentation panel.

NOTE: The cylinder used for this test must contain the following minimum pressure:

O_2	: 1000 Psi
N_2O	: 700 Psi
HE	: 1000 Psi
CO_2	: 800 Psi
AIR	: 1000 Psi
N_2	: 1000 Psi

4.4.14.2 Close the cylinder valve and remove the cylinder from the yoke.

4.4.14.3 For any gas, the pressure should not drop more than 50 Psi in two minutes.

4.4.15 Re-install the cylinder in the yoke.

4.4.16 Place the plexiglass cover over the gauges and flow tubes, and ensure that the cover is fitted properly over the flow control valves.

4.4.17 Place the knob guard over the flow control valves and install its two retaining screws.

4.4.18 Install the oxygen flow control knob and tighten its setscrews. If the knobs are installed properly, their labels will be straight when the knobs are against their clockwise stops.

4.4.19 Replace the front plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.4.20 Replace the rear cover and its retaining screws.

4.4.21 Reinstall the table top and tighten its retaining screws.

4.4.22 Connect the pipeline hoses.

4.4.23 Perform the PMC Procedure given in Section 6.

4.5 Flowmeters

The flowmeter tubes are held by compression in gaskets at the top and bottom of each tube. Each upper gasket is seated in an adjustable retainer that allows removal of the tube as shown in Figure 4-5. Access to the flow tubes and their retainers requires removal of the plexiglass cover on the gas instrumentation panel.

4.5.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.5.2 Close all cylinder valves except the O_2 valve.

4.5.3 Set the oxygen flow to 5 liters per min.

4.5.4 Open the other gas flow control valves to drain pressure from the system.

4.5.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.5.6 Set the System Power switch to STANDBY.

4.5.7 Loosen the screws holding the table top to the machine and lift out the table top.

4.5.8 Remove the screws holding the flowmeter shield and vapor box front cover panel, and remove the panel.

4.5.9 Remove the oxygen flow control knob. The knob has two setscrews.

NOTE: If the knob must be rotated to allow access to a setscrew, carefully note its position so that it can be re-assembled in the same position with the "Off Stop" properly set.

4.5.10 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.5.11 Carefully remove the plexiglass cover from the front of the flowmeter housing.

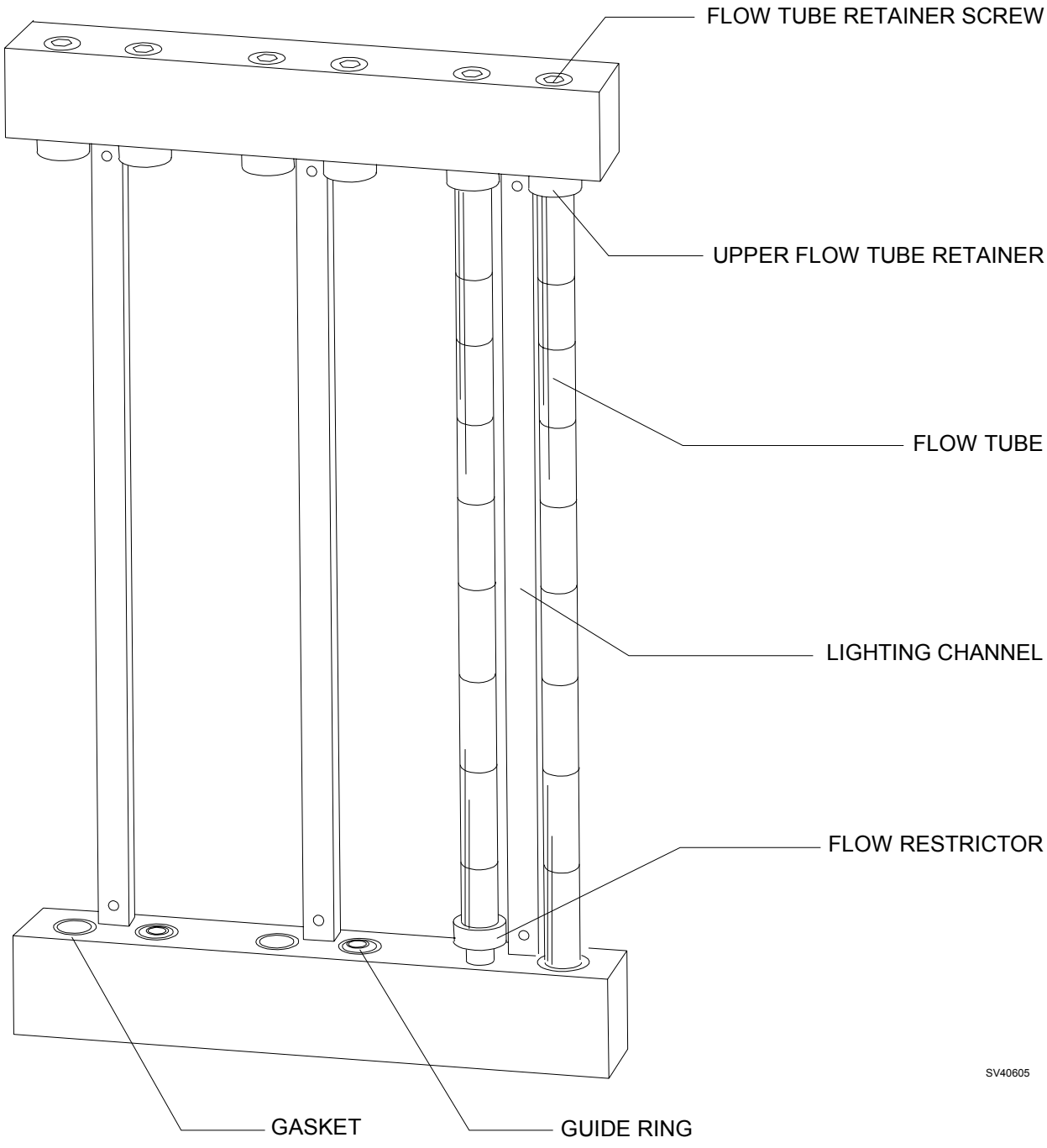

FLOW TUBE RETAINER SCREW
UPPER FLOW TUBE RETAINER
FLOW TUBE
LIGHTING CHANNEL
FLOW RESTRICTOR
SV40605
GASKET
GUIDE RING

Figure 4-5.

4.5.12 Loosen the screw directly above the flowmeter tube to be replaced. Turning the screw counter clockwise will raise the upper flow tube retainer. Raise the retainer far enough to be able to pull the top of the tube outward, and remove the tube.

NOTE: If the bottom of the tube is seated in a flow restrictor, be sure that the arrangement of the restrictor and its gaskets is not disturbed.

4.5.13 Make sure that the replacement flow tube bears the correct markings and has a ball.

4.5.14 Place the bottom of the flowmeter tube into the guide ring of the lower gasket seal, and position the top of the flow tube into the center guide ring of the top gasket seal. It will be easier to hold the tube if the adjacent lighting channel is pulled forward and temporarily removed.

CAUTION: The flowmeter tube must be properly centered over the guide rings or damage to the flowmeter tube may occur.

4.5.15 Ensure that the markings on the flow tube are facing forward, and turn the upper retainer screw clockwise until the flow tube is firmly held in place.

CAUTION: Do not over-tighten the screw as the flowmeter tube may break.

4.5.16 Perform the following leak test on the system:

4.5.16.1 Disconnect the absorber hose from the fresh gas outlet. Ensure that all flow control valves are closed.

4.5.16.2 Connect a test gauge and B.P. bulb to the fresh gas outlet, and pressurize the system to 50 cm H_2O.

4.5.16.3 The pressure should not drop more than 10 cm H_2O in thirty seconds.

4.5.17 Disconnect the test gauge and re-connect the absorber hose to the fresh gas outlet.

4.5.18 Replace any lighting channels that were previously removed.

4.5.19 Place the plexiglass cover over the gauges and flow tubes, and ensure that the cover is fitted properly over the flow control valves.

4.5.20 Place the knob guard over the flow control valves and install its two retaining screws.

4.5.21 Install the oxygen flow control knob and tighten its setscrews. If the knobs are installed properly, their labels will be straight when the knobs are against their clockwise stops.

4.5.22 Replace the front plate at the top of the plexiglass cover and secure it with the hardware that was previously removed.

4.5.23 Reinstall the table top and tighten its retaining screws.

4.5.24 Connect the pipeline hoses.

4.5.25 Perform the PMC Procedure given in Section 6.

4.6 Flow Control Valves

The flow control valves have replaceable elements that are removable from the front of the gas instrumentation panel as shown in Figure 4-6. Each flow control knob has a clockwise positive stop arrangement that prevents damage to the valve seat. Whenever a valve cartridge is replaced, the "off stop" must be set as outlined in the following procedure.

4.6.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.6.2 Close all cylinder valves except the O_2 valve.

4.6.3 Set the oxygen flow to 5 liters per min.

4.6.4 Open the other gas flow control valves to drain pressure from the system.

4.6.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.6.6 Set the System Power switch to STANDBY.

4.6.7 Remove the oxygen flow control knob.

4.6.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.6.9 Remove the knob (if not already removed) from the valve that is being replaced, and remove the stop pin nut.

4.6.10 Remove the flow control valve by holding it at the wrench flats and turning it counter-clockwise.

4.6.11 Install the replacement flow control valve in the valve body.

CAUTION: Before tightening the cartridge, rotate the valve shaft several turns counter-clockwise to prevent bottoming the valve element into the seat when the cartridge is tightened.

4.6.12 Replace the stop pin nut.

4.6.13 Replace the knob guard and secure it with the two mounting screws.

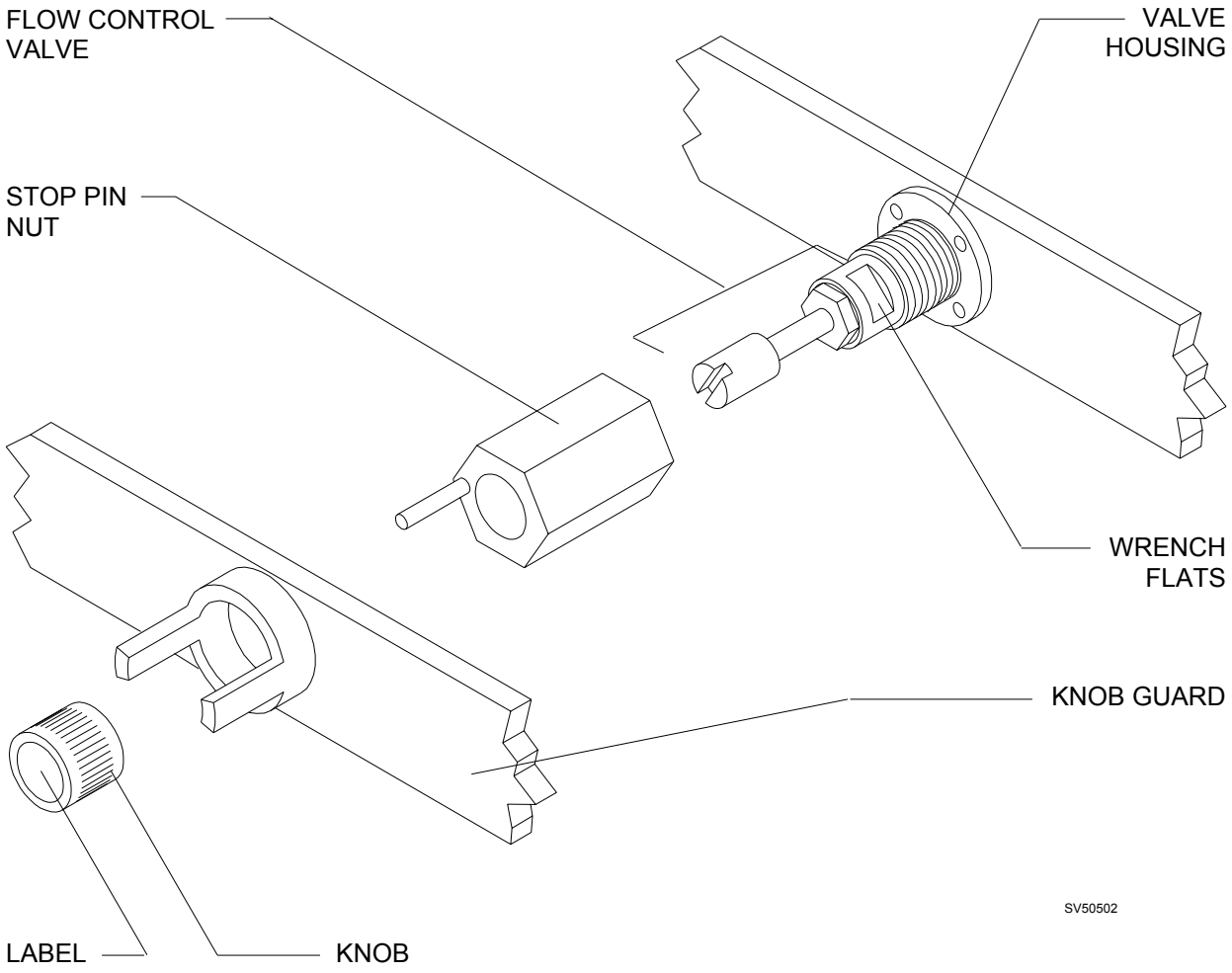


Figure 4-6. Flow Control Valves

4.6.14 Turn the System Power switch to ON.

4.6.15 A: For the O_2 flow control valve:

Open the oxygen cylinder valve.

Turn the flow control valve clockwise until the flow rate will not drop any further. (If the machine has been modified to eliminate the minimum flow feature, turn the valve until the flow rate is zero.)

4.6.15 B: For the other gas flow control valves:

Open the oxygen cylinder valve, and open the cylinder valve corresponding to the flow control valve replacement.

Set the oxygen flow rate to four liters per minute.

Turn the other gas flow control valve clockwise until the flow rate is zero.

4.6.16 Place the knob on the flow control valve shaft and turn it clockwise until it engages the stop pin. Tighten one of the knob setscrews.

4.6.17 Turn the knob in both directions and ensure that the flow can be controlled over its entire range. When the valve is closed, the knob should be against the clockwise stop. Tighten the remaining setscrew.

4.6.18 If the knob label is not horizontal when the valve is closed, remove the label and install a new label in the correct position.

4.6.19 Connect the pipeline hoses.

4.6.20 Perform the PMC Procedure given in Section 6.

4.7 Auxiliary Oxygen Flow Meter

The auxiliary oxygen flowmeter is attached to the side of the machine's flowmeter housing by two screws (or by a stud and nut arrangement) -accessible from inside the housing. A flexible O_2 supply tube from the flowmeter connects to a hose barb fitting at the system power switch. Figure 4-7 shows a typical mounting and tubing arrangement.

4.7.1 Disconnect all pipeline hoses and close all cylinder valves.

4.7.2 Press the O_2 Flush button to drain oxygen pressure from the system.

4.7.3 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.7.4 Remove the back cover from the flowmeter housing.

4.7.5 Cut the tie strap on the flexible tube at the system power switch, and remove the tube.

4.7.6 Remove the screws (or nuts) securing the auxiliary O_2 flowmeter, and remove the flowmeter.

4.7.7 Position the replacement flowmeter at the side of the flowmeter housing (feed the flex tubing through the clearance hole) and secure the auxiliary O_2 flowmeter with the two screws (or nuts) that were previously removed.

4.7.8 Connect the flex tubing to the hose barb fitting behind the Clippard valve, and secure it with a tie strap.

4.7.9 Reinstall the flowmeter housing back cover.

4.7.10 Connect the pipeline hoses and restore AC power to the machine.

4.7.11 Perform the PMC Procedure given in Section 6.

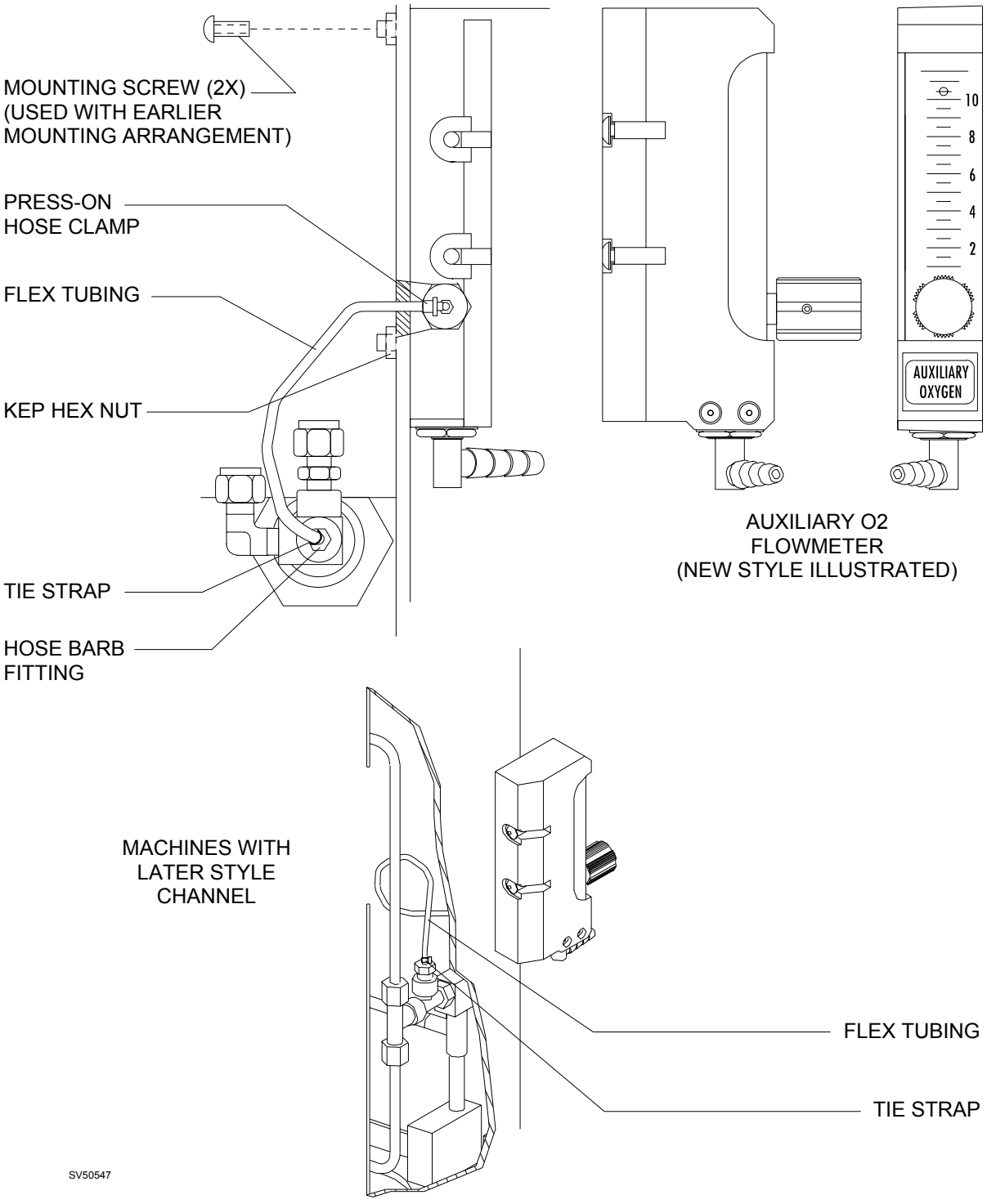


Figure 4-7. Auxiliary O_2 Flowmeter

4.8 Oxygen Supply Pressure Failure Protection Device

The oxygen supply failure protection devices (failsafe assemblies) are located within the flowmeter housing. Access to these assemblies requires removal of the rear cover. Figure 4-8 shows a typical arrangement of a failsafe assembly and its connections.

4.8.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.8.2 Close all cylinder valves except the O_2 valve.

4.8.3 Set the oxygen flow to 5 liters per min.

4.8.4 Open the other gas flow control valves to drain pressure from the system.

4.8.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.8.6 Set the System Power switch to STANDBY.

4.8.7 Remove the screws holding the rear cover, and remove the cover.

4.8.8 Disconnect the flexible O_2 control line.

4.8.9 isconnect the compression fittings at the side ports and at the check valve, and remove the assembly.

NOTE: If fittings must be installed in the replacement block assembly, use Loctite #271 (red). Fittings are listed in Section 8.

4.8.10 Install the replacement failsafe assembly, and tighten the three compression fittings.

4.8.11 Connect the flexible tubing to the control port, and secure the connection with the hose clamp.

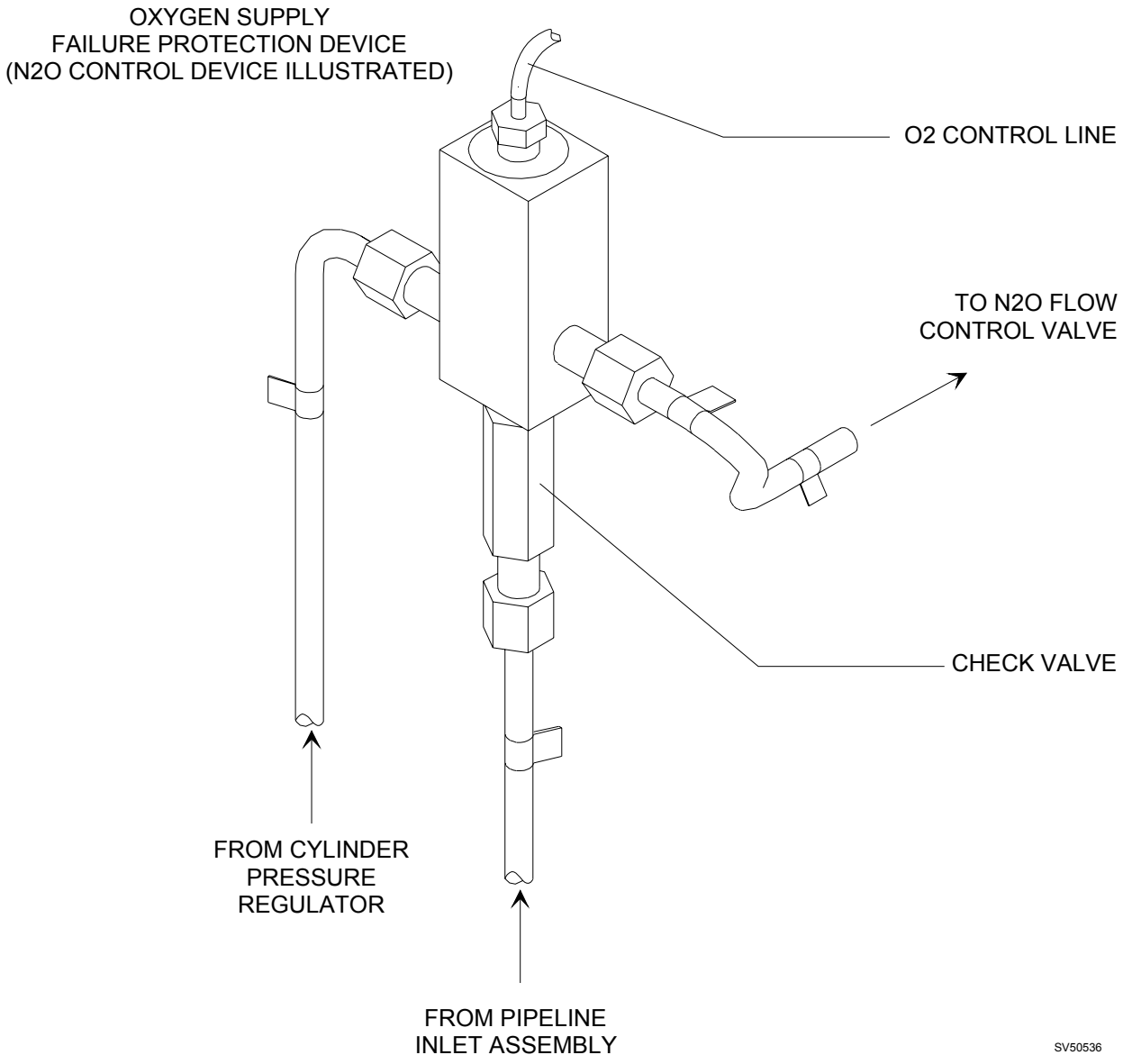


Figure 4-8. Oxygen Supply Failure Protection Device

4.8.12 Perform the following test:

4.8.12.1 Open the cylinder valves.

4.8.12.2 Set the System Power switch to ON.

4.8.12.3 Set the oxygen flow to five liters per minute.

4.8.12.4 Set the other gas flow to five liters per minute.

4.8.12.5 Close the oxygen cylinder valve.

4.8.12.6 As the oxygen flow decreases, the other gas flow should stop.

4.8.12.7 Set the System Power switch to STANDBY.

4.8.13 Reinstall the rear cover and its retaining screws.

4.8.14 Connect the pipeline hoses.

4.8.15 Perform the PMC Procedure given in Section 6.

4.9 Alarm Channel and Oxygen Supply Pressure Alarm Switch

The alarm channel assembly includes the oxygen supply pressure alarm switch, the alarm circuit board, and the system power switch.

NOTE: Service replacement alarm channel assemblies are supplied without the O_2 supply pressure alarm switch and wire harness.

Whenever the alarm channel is replaced, the oxygen supply pressure alarm switch must be tested to ensure that its operating point is set correctly. Removal of the alarm channel requires removal of the upper flowmeter cover plate, and removal of the flowmeter housing rear cover. The alarm channel assembly is held in place by two screws from the back. Figure 4-9 shows a rear view of the assembly and its connections.

4.9.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.9.2 Close all cylinder valves except the O_2 valve.

4.9.3 Set the oxygen flow to 5 liters per min.

4.9.4 Open the other gas flow control valves to drain pressure from the system.

4.9.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.9.6 Set the System Power switch to STANDBY, and remove AC power from the machine.

4.9.7 Disable the circuit breakers on the power supply by pulling out each button with a knife or sharp object.

4.9.8 Remove the screws holding the flowmeter shield and vapor box front cover panel, and remove the panel.

4.9.9 Remove the screws holding the flowmeter housing rear cover, and remove the cover.

4.9.10 Loosen the screws holding the table top, and lift out the table top.

4.9.11 Disconnect the cables from J1, J2, J3 and J4 on the alarm circuit board.

4.9.12 Disconnect the compression fitting on the O_2 line nearest to the oxygen supply pressure alarm switch.

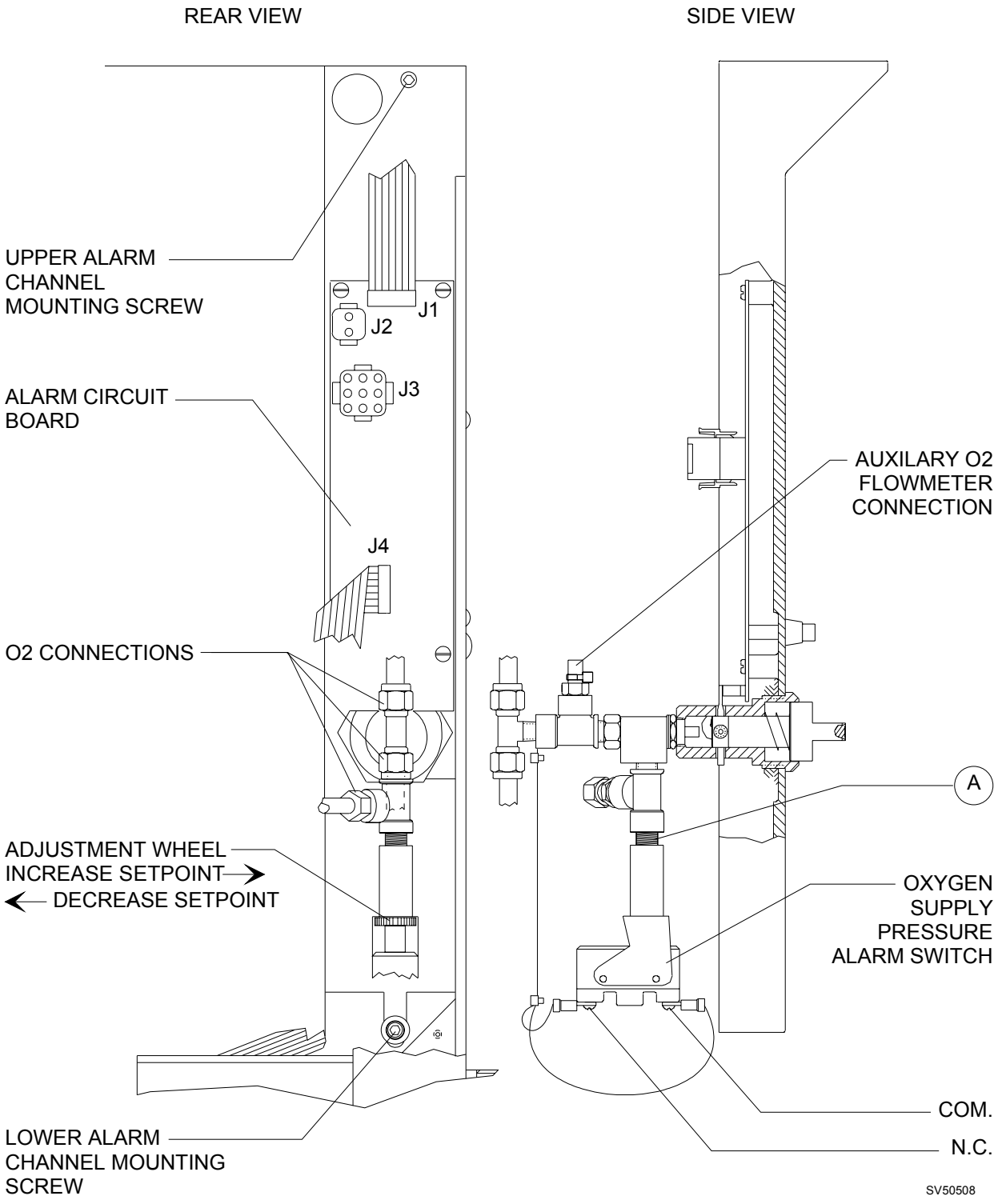


Figure 4-9. Alarm Channel and Oxygen Supply Pressure Alarm Switch

4.9.13 Disconnect the remaining two O_2 lines at the top and bottom of the tee fitting.

4.9.14 If the machine is equipped with an auxiliary O_2 flowmeter, cut the tie strap on its flexible line and carefully remove the flex line from the hose barb.

4.9.15 From the back of the flowmeter housing, remove the upper and lower alarm channel mounting screws.

4.9.16 At the front of the machine, pull the alarm channel assembly forward, and feed the flowmeter lights wire harness through the hole at the top of the alarm channel.

4.9.17 Disconnect the orange and orange/white wires from the oxygen supply pressure alarm switch.

4.9.18 The following steps apply to replacement of the oxygen supply pressure alarm switch.

4.9.19 Remove the alarm switch from the assembly at point as shown in the illustration.

4.9.20 Install the replacement alarm switch with sealing tape on the threads, and ensure that the switch is oriented on the assembly as shown in the illustration.

4.9.21 Connect the orange and orange/white wires to the replacement switch in the same manner as the original.

4.9.22 Feed the flowmeter lights wire harness through the hole at the top of the alarm channel, and set the alarm channel assembly into place.

4.9.23 Install the upper and lower alarm channel mounting screws.

4.9.24 If applicable, reconnect the flex line from the auxiliary O_2 flowmeter and install a new tie strap at the hose barb.

4.9.25 Reconnect the the O_2 lines, and tighten the three compression fittings.

4.9.26 Reconnect the cables to J1, J2, J3 and J4 on the alarm circuit board.

4.9.27 Reinstall the front flowmeter cover with the screws that were previously removed.

4.9.28 Pull the writing tray out to its fully extended position.

4.9.29 Locate the tee fitting in the ¼ in. diameter output line of the O_2 regulator and remove the plug from the tee fitting.

4.9.30 Connect a dedicated O_2 test gauge to the tee fitting.

4.9.31 Connect AC power to the machine and enable the circuit breakers by pressing their buttons in.

4.9.32 Open an oxygen cylinder valve and turn the System Power switch to ON.

4.9.33 Set the oxygen flow to five liters per minute.

4.9.34 Close the oxygen cylinder valve.

4.9.35 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

4.9.36 If the alarm activates when the pressure is below 34 psi or above above 40 psi, turn the adjustment wheel (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

4.9.37 Turn the System Power switch to STANDBY.

4.9.38 Disconnect the test gauge and replace the plug in the regulator line tee fitting.

4.9.39 Reinstall the table top and tighten its retaining screws.

4.9.40 Reinstall the flowmeter housing rear cover and its retaining screws.

4.9.41 Connect the pipeline hoses.

4.9.42 Perform the PMC Procedure given in Section 6.

4.10 Oxygen Ratio Controller

The Oxygen Ratio Controller (ORC) is part of the N_2O flowmeter sub-assembly and is located within the flowmeter housing. The ORC is accessible by removing the rear flowmeter housing cover. Figure 4-10 shows a typical ORC location and mounting arrangement, with a detail of the O-rings and filter.

4.10.1 Disconnect all pipeline hoses and set the System Power switch to ON.

4.10.2 Close all cylinder valves except the O_2 valve.

4.10.3 Set the oxygen flow to 5 liters per min.

4.10.4 Open the other gas flow control valves to drain pressure from the system.

4.10.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.10.6 Set the System Power switch to STANDBY.

4.10.7 Remove the press-on clamp securing the flexible O_2 line to the ORC, and carefully disconnect the tubing from the hose barb.

4.10.8 Remove the three screws holding the ORC to the flowmeter sub-assembly, and carefully remove the ORC from the flowmeter housing.

4.10.9 Install the 6 in. length of flexible tubing with a blue N_2O label on the replacement ORC (see detail view in illustration) Secure each connection with a press-on hose clamp.

Position the replacement ORC at the back of the N_2O flowmeter sub-assembly; be sure that its O-rings and filter are in place, and install its three mounting screws.

4.10.10 Connect the flexible O_2 line to the ORC and secure it with the press-on hose clamp.

4.10.11 Open the O_2 and N_2O cylinder valves.

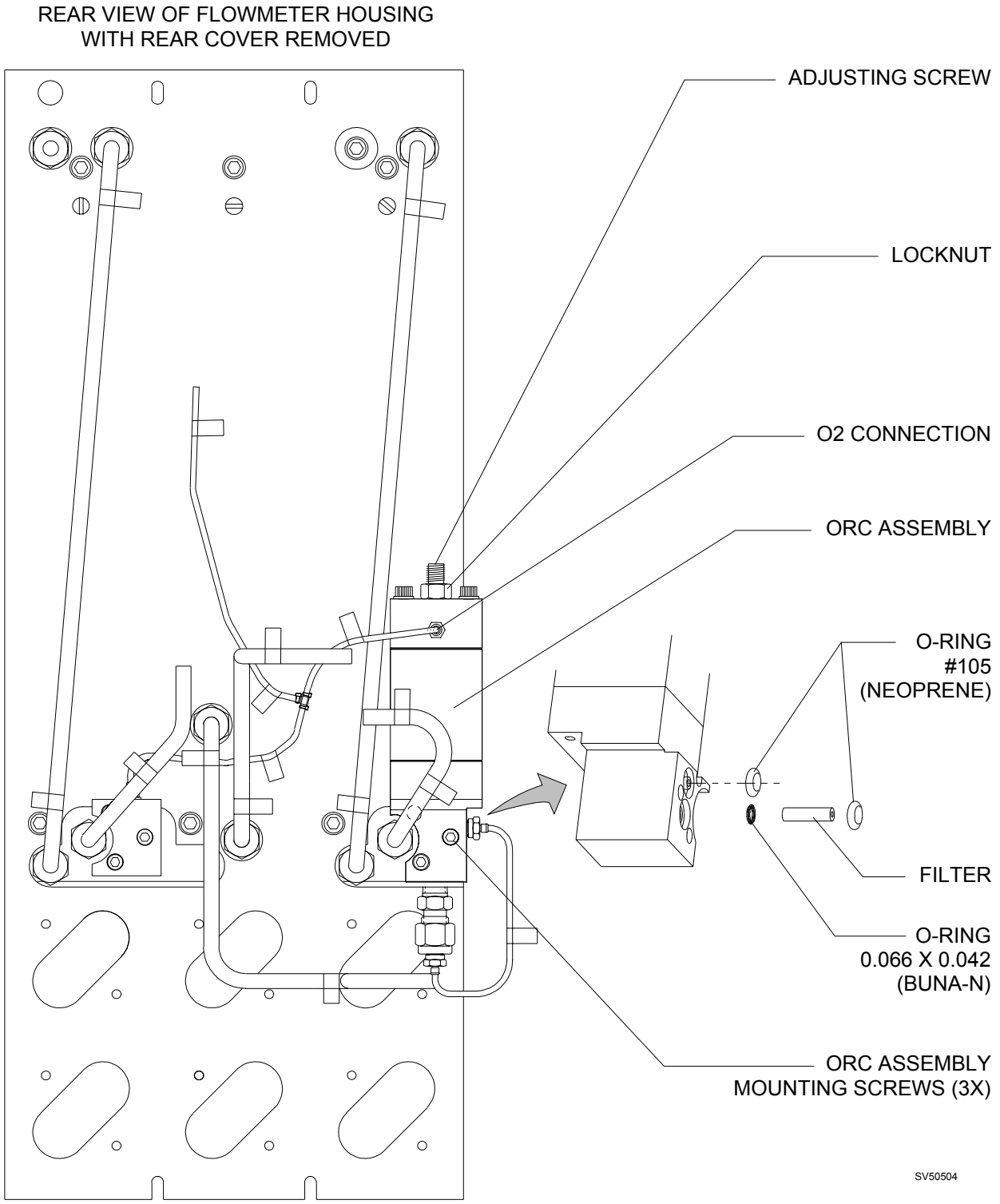


Figure 4-10. Oxygen Ratio Controller

4.10.12 Perform the ORC adjustment procedure given in Section 5 of this manual.

4.10.13 Reinstall the flowmeter housing rear cover.

4.10.14 Perform the PMC Procedure given in Section 6.

4.11 Vaporizers

Each vaporizer is held to the machine by two metric sized hex screws. These screws are located at the back of the vaporizer manifold, and are accessible by removing the cover from the interlock mechanism as shown in Figure 4-11. Before removing a vaporizer from the machine, it must be completely drained and dried in accordance with the procedure given below. Be sure to have a suitable packing or storage container available in which to place the vaporizer.

CAUTION: The following steps must be performed in the sequence given.

4.11.1 Turn the System Power switch to ON.

4.11.2 Set all vaporizer handwheels to their Zero or OFF position.

WARNING:Do not inhale anesthetic vapors as this could result in personal injury.

4.11.3 Remove the filler and drain plugs, and drain the vaporizer into a suitable container. Dispose of the residual agent in an approved manner.

4.11.4 Turn the vaporizer handwheel to the maximum concentration setting.

4.11.5 Set the oxygen flow to 10 l/min. for at least 20 minutes.

WARNING:This procedure must be performed in a well ventilated area and without personnel present.

4.11.6 Turn the vaporizer handwheel to 0 (zero), and replace the filler and drain plugs.

4.11.7 Turn the oxygen flow off, and turn the System Power switch to STANDBY.

4.11.8 Remove the back cover from the vaporizer interlock mechanism.

4.11.9 While holding the vaporizer, remove the mounting screws and carefully separate the vaporizer from the machine. Note the arrangement of gaskets so that the replacement vaporizer can be installed in the same manner.

4.11.10 Place the vaporizer in a suitable container for transport or storage.

WARNING:Do not tilt a vaporizer that contains anesthetic agent more than 45 degrees. Failure to observe this precaution will render the handwheel calibration invalid.

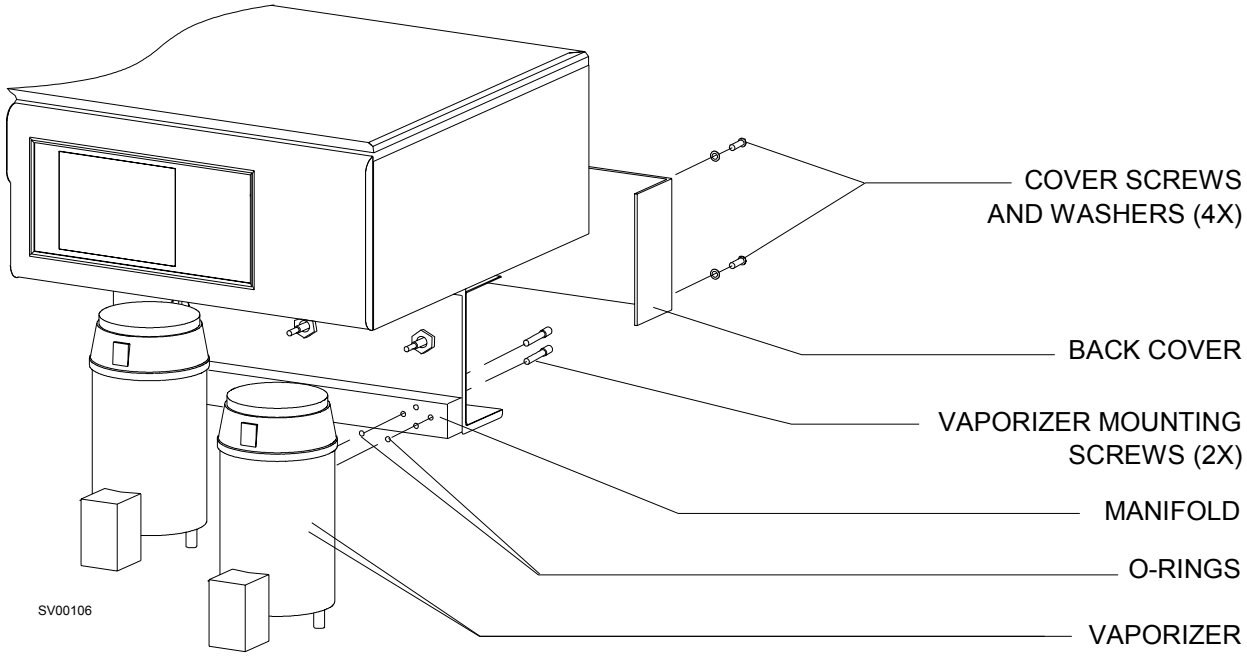


Figure 4-11. Vaporizer Installation

NOTE: Should a vaporizer containing anesthetic agent be accidentally tilted more than 45 degrees, it must be drained and flushed in accordance with instructions given in the manual supplied with the vaporizer.

4.11.11 Set the handwheel on the replacement vaporizer to its Zero position.

4.11.12 Install the replacement vaporizer on the machine (be sure the O-rings are in place) and tighten the mounting screws to a torque of 24 to 26.5 inch pounds.

4.11.13 Perform the following test on the interlock mechanism:

4.11.13.1 Turn the center vaporizer handwheel ON. The left and the right vaporizer handwheels should be locked in their Zero position.

4.11.13.2 Turn the center vaporizer OFF and turn the left vaporizer ON.

4.11.13.3 Turn the left vaporizer OFF and turn the right vaporizer ON. The center and the left vaporizer handwheels should be locked in their Zero position.

NOTE: If the vaporizer interlock mechanism is not working properly, refer to the adjustment procedure given in Section 5.

4.11.14 Reinstall the back cover on the vaporizer interlock mechanism.

4.11.15 Perform the PMC Procedure given in Section 6.

4.12 O2 Flush Valve

The O_2 flush valve is located at the front of the machine next to the fresh gas outlet. Access to the flush valve requires removal of the table top. Figure 4-12 shows the mounting and assembly details of the flush valve.

4.12.1 Turn the System Power switch to STANDBY.

4.12.2 Disconnect all pipeline hoses.

4.12.3 Close the O_2 cylinder valve.

4.12.4 Press the O_2 Flush valve to drain oxygen pressure from the system.

4.12.5 Loosen the screws holding the table top to the machine and lift out the table top.

4.12.6 Hold the O_2 Flush button in and rotate it until one of its set screws are visible through an access hole in the guard ring, and loosen the set screw.

4.12.7 Turn the O_2 Flush button 180 degrees, hold it in and loosen the other set screw.

4.12.8 Remove the O_2 Flush button and washer from the valve shaft.

4.12.9 Disconnect the two compression fittings at the valve.

NOTE: Do not lose the flow restrictor located at the right-angle fitting. This restrictor will be transferred to the replacement valve assembly.

4.12.10 The O_2 Flush valve is retained by the guard ring on the front of the machine frame. Hold the body of the Clippard valve with an open end wrench; insert a rod or hex wrench through the holes in the guard ring (or use a spanner wrench), and un-screw the guard ring from the front of the frame rail.

4.12.11 Assemble the replacement O_2 Flush valve, spacer, internal tooth lock washer and guard ring through the frame and tighten the assembly, making sure that the valve is mounted straight.

4.12.12 Connect the compression fittings to the valve. Be sure the flow restrictor is in place at the right-angle fitting.

4.12.13 Place the washer and the O_2 Flush button on the valve shaft.

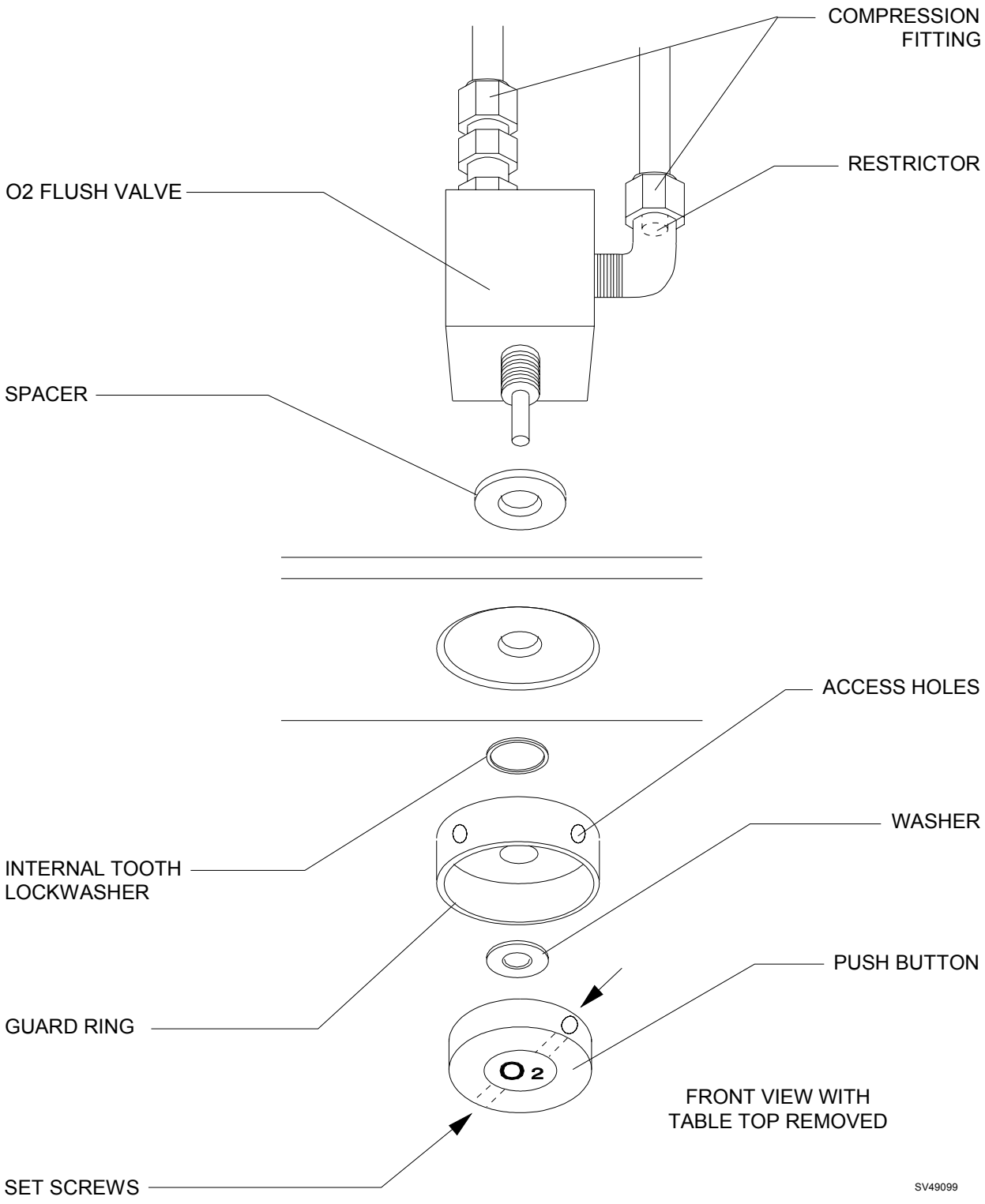


Figure 4-12. O_2 Flush Valve

4.12.14 Hold the O_2 Flush button in and turn it until a set screw is visible through an access hole in the guard ring. Tighten the set screw. Rotate the button 180 degrees until the other set screw is visible, and tighten the set screw.

4.12.15 Disconnect the absorber fresh gas hose from the fresh gas outlet. Connect a test gauge and B.P. bulb to the fresh gas outlet, and perform the following test:

4.12.15.1 Open the oxygen cylinder valve and allow the pressure to stabilize. (The cylinder pressure must be at least 1000 psi for this test.)

4.12.15.2 Release any pressure that is indicated on the test gauge.

4.12.15.3 Over the next 60 seconds, the test gauge should not show a pressure increase greater than 2 cm H_2O.

4.12.15.4 Increase the pressure to 50 cm H_2O.

4.12.15.5 The pressure should not drop more than 10 cm H_2O in the next 30 seconds.

4.12.15.6 Disconnect the test gauge from the fresh gas outlet.

4.12.15.7 Close the oxygen cylinder valve.

4.12.15.8 The pressure should not drop more than 50 psi in two minutes.

4.12.15.9 Connect a volumeter to the fresh gas outlet, and reset the volumeter to zero.

4.12.15.10 Press the O_2 Flush button and observe the flow rate. It should be between 45 and 65 liters per minute.

4.12.15.11 Disconnect the volumeter from the fresh gas outlet.

4.12.16 Connect the absorber fresh gas hose to the fresh gas outlet.

4.12.17 Reinstall the table top and tighten its mounting screws.

4.12.18 Connect the pipeline hoses.

4.12.19 Perform the PMC Procedure given in Section 6.

4.13 AV-2+ Ventilator Controller Assembly

The Ventilator Controller assembly is attached to the left front panel of the ventilator box and includes electrical and pneumatic components. Figure 4-13 shows the mounting screw locations and connections to the ventilator controller. Figure 4-13A shows a later design.

4.13.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.13.2 Disconnect all pipeline hoses and close all cylinder valves.

CAUTION: The controller circuit board contains static sensitive devices. Use ESD protection when handling the controller assembly.

4.13.3 Remove the two screws securing the left end of the ventilator controller panel.

4.13.4 Pull the left side of the panel outward, slide it to the left until the locking tab on the right side of the panel is clear of its receptacle, then pull the assembly out far enough to gain access to its connections.

4.13.5 Disconnect the alarm channel wiring harness from J2 on the controller circuit board, and disconnect the Man/Auto selector interface cable from J7 on the circuit board.

4.13.6 Disconnect the following large and small diameter pneumatic tubing (the letters are keyed to the illustration - Figures 4-13 and 4-13A):

A: Small dia. tube from solenoid to rear vent fitting on bellows box
B: Large dia. tube from supply valve to venturi
C: Small dia. tube to auto-ranging valve
D: Large dia. tube from main switch (O_2 supply)

4.13.7 Remove the controller assembly from the machine.

4.13.8 Position the replacement controller assembly in the ventilator box and reconnect the four pneumatic lines.

4.13.9 Reconnect the alarm channel wire harness to J2 on the controller circuit board, and the Man/Auto selector interface cable to J7 on the circuit board.

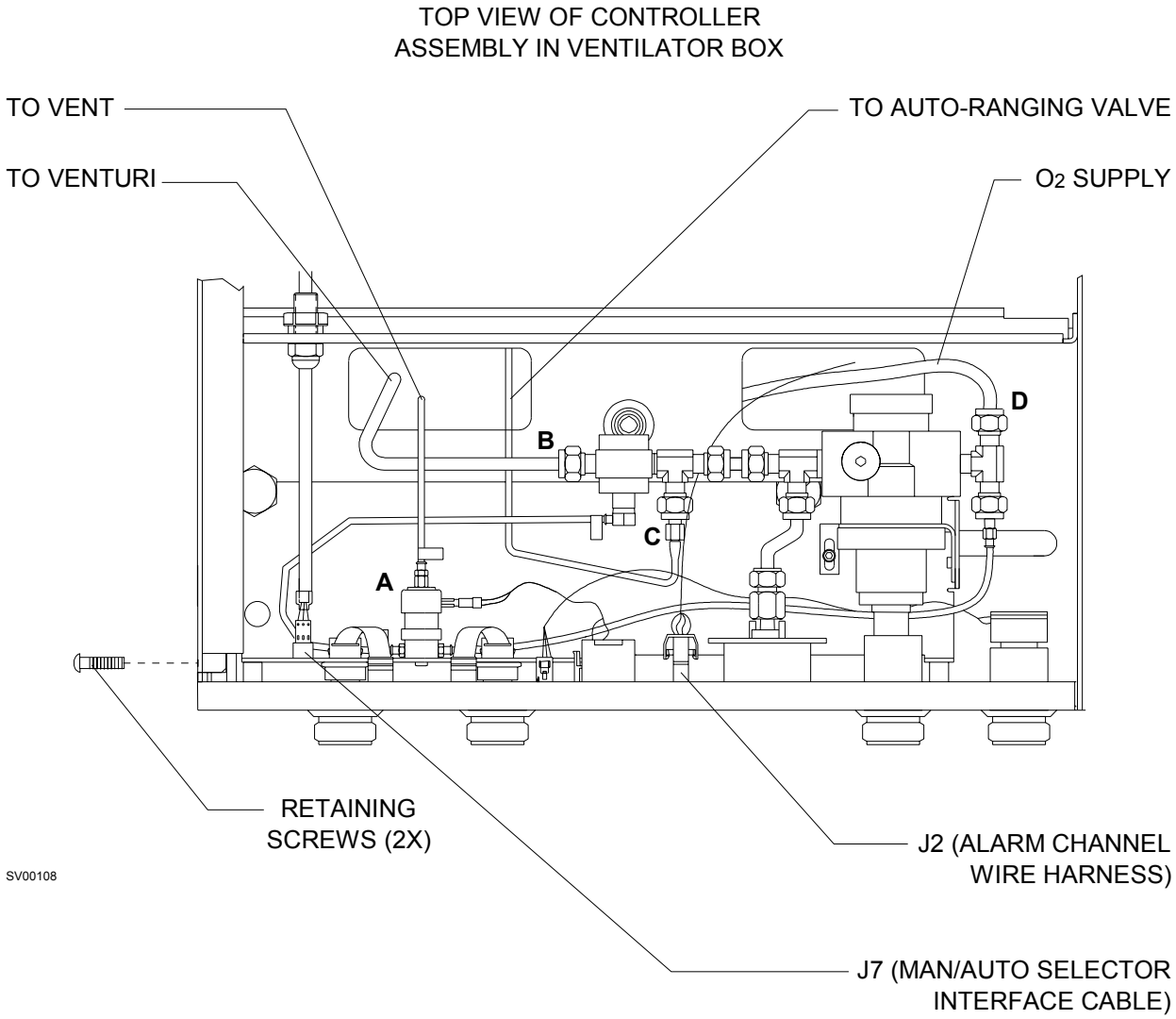


Figure 4-13. AV2+ Ventilator Controller Assembly

4.13.10 Slide the controller into the ventilator box, carefully fit the locking tab into its receptacle at the right side of the panel, and slide the assembly to the right until it is properly seated.

4.13.11 Reinstall the two retaining screws at the left side of the panel.

4.13.12 Perform the PMC Procedure given in Section 6.

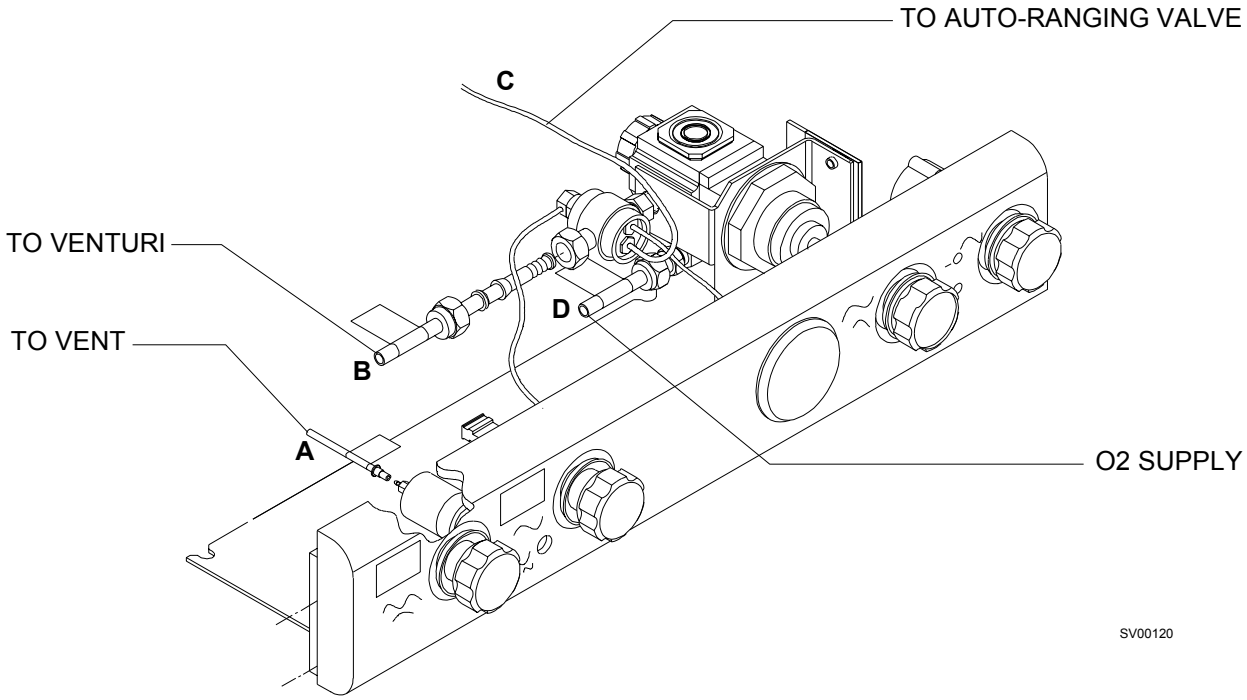


Figure 4-13A. AV2+ Ventilator Controller Assembly, Later Design

4.14 Ventilator Bellows Valve and Guide Assembly with Pressure Limit Control

The Ventilator Bellows Valve and Guide Assembly, and the Pressure Limit Control are located in the bellows box on the left side of the machine. Access to the components requires removal of the bellows box front panel, and removal of the upper bellows support plate from the bellows box. Figure 4-14 shows the pneumatic connections and the mounting arrangement of the components.

4.14.1 Turn the System Power switch to STANDBY, and remove AC power from the machine.

4.14.2 Close all cylinder valves, and disconnect the pipeline hoses from the machine.

4.14.3 Press the O_2 Flush button to relieve pressure from the system.

4.14.4 Adjust the TIDAL VOLUME control to raise the volume indicator to its minimum setting.

4.14.5 Disconnect the breathing hose and the scavenger hose from the bellows assembly. Loosen the wing nuts and remove the bellows assembly.

4.14.6 Remove the canister from the bellows box by pulling it downward.

4.14.7 Unscrew the bellows adjustment tube from the bellows valve assembly.

4.14.8 Remove the screws holding the bellows box front panel and knob assemblies, and remove the panel.

4.14.9 Loosen the rear support plate screw, and remove the two front support plate screws.

4.14.10 Pull the support plate forward, then lower it to a point where the tubing connections are accessible.

4.14.11 Disconnect the large diameter tubing from the venturi, and the small diameter tubing from the auto-ranging valve.

4.14.12 Carefully remove the assembly from the machine.

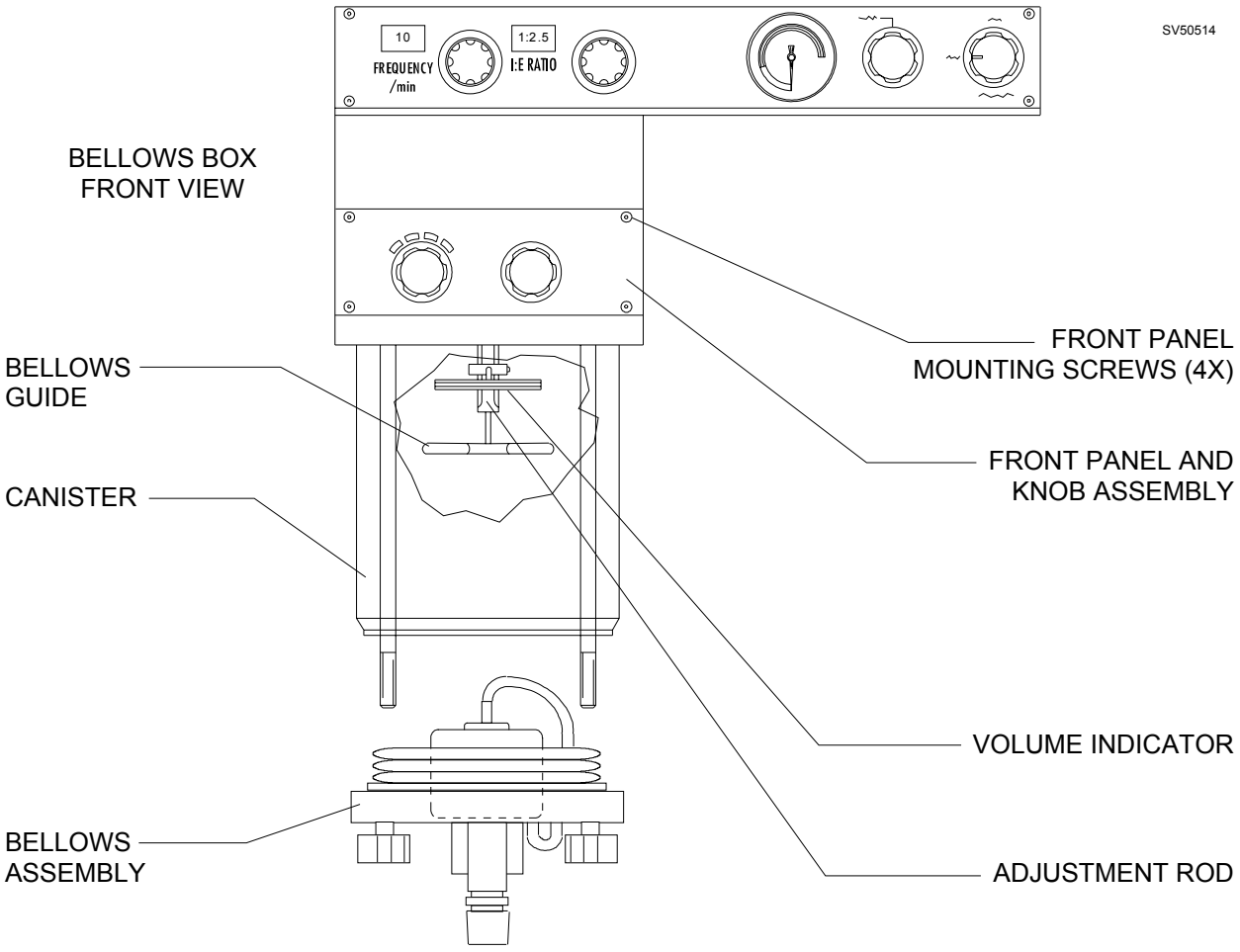


Figure 4-14. Tidal Volume Adj. & Valve Case Assembly

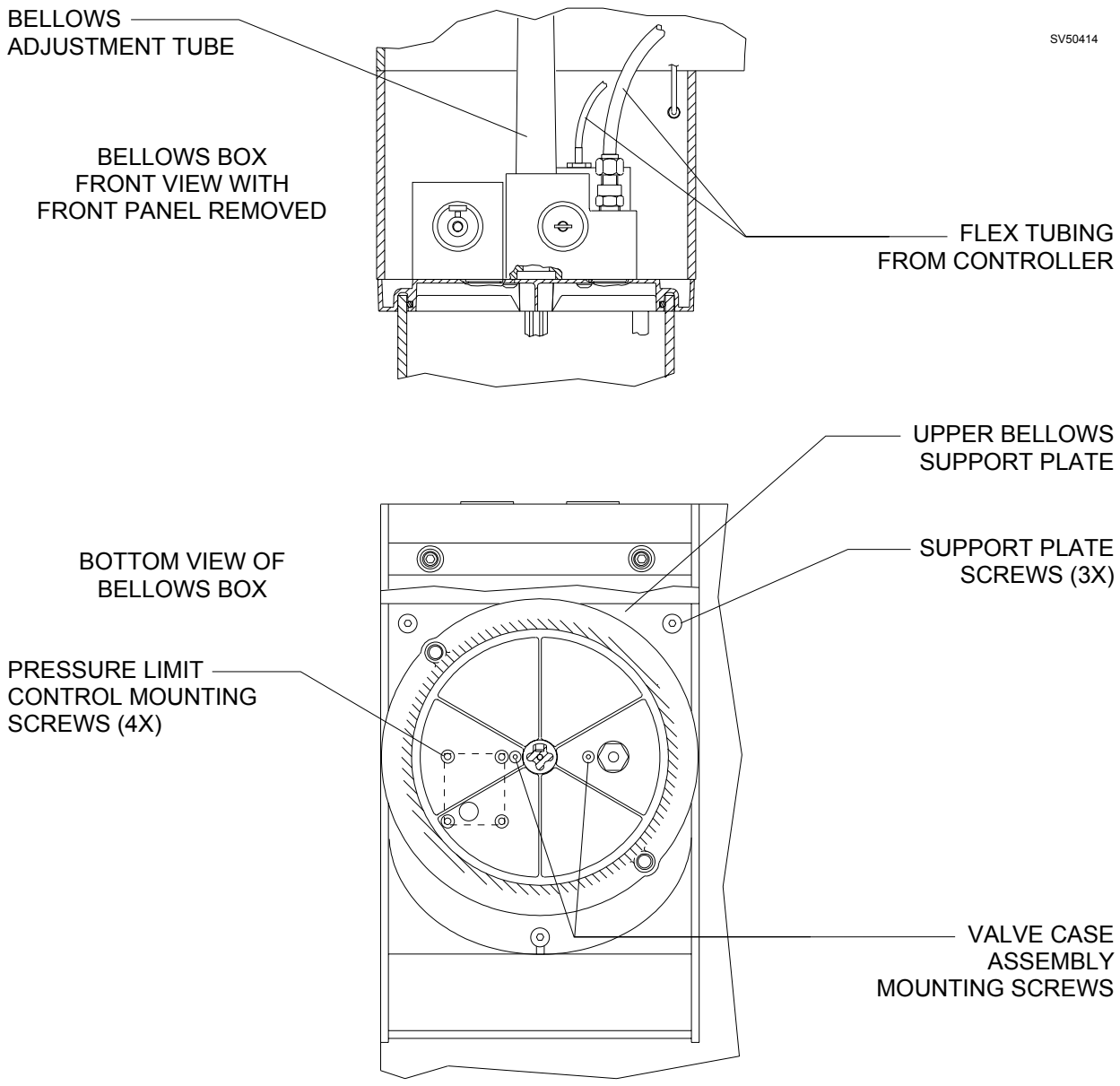


Figure 4-14 continued. Tidal Volume Adj. & Valve Case Assembly

4.14.13 Unscrew the bellows adjustment tube from the replacement bellows valve.

4.14.14 Position the support plate in the bellows box and reconnect the large and small diameter tubing that was previously removed.

4.14.15 Slide the support plate up and to the rear until it is seated properly in the bellows box.

4.14.16 Reinstall the two front support plate screws, and tighten the rear support plate screw.

4.14.17 Reinstall the bellows adjustment tube on the bellows valve.

4.14.18 Place the bellows box front panel into position, ensure that the slots in the knob assemblies are correctly aligned with their drive pins on the bellows adjustment and pressure limit control shafts, and reinstall the screws holding the front panel to the machine.

4.14.19 Replace the bellows canister; ensure that its markings are facing forward.

4.14.20 Replace the bellows assembly and tighten the wing nuts holding it in place.

4.14.21 Reconnect any hoses that were previously removed from the bellows assembly.

4.14.22 Reconnect the pipeline hoses and AC power cord.

4.14.23 Perform the PMC Procedure given in Section 6.

4.15 Caster

Each caster is retained by a set screw in the side of the lower frame rail as shown in Figure 4-15. Caster replacement requires that the machine be tilted to provide enough clearance for the caster stem to be withdrawn from the bottom of the frame rail.

WARNING: Do not tilt the machine more than 10 degrees or raise the casters more than 3½ inches from the floor. Failure to observe this precaution may result in a tip-over, causing personal injury. Vaporizers containing anesthetic agent may also be damaged.

4.15.1 Obtain a brace capable of supporting one side of the machine with its casters two to three inches from the floor.

4.15.2 Remove all unsecured equipment and accessories from the machine.

4.15.3 Lock the front casters.

4.15.4 Using at least two people, tilt the machine until the casters on one side are raised two to three inches from the floor, and position the support brace under the frame rail between the front and back casters.

4.15.5 Remove the plastic cap in the side of the frame rail to provide access to the caster stem set screw.

4.15.6 Loosen the set screw and remove the caster.

4.15.7 Insert the replacement caster into the frame and hold it in its seated position.

4.15.8 Tighten the caster stem set screw and replace the plastic cap in the frame rail.

4.15.9 Using at least two people, tilt the machine, remove the support brace and carefully lower the machine to the floor.

4.15.10 Check for proper operation of the caster and ensure that the front casters lock properly.

4.15.11 Perform the PMC Procedure given in Section 6, including a vaporizer calibration verification.

4.15.12 Replace any unsecured equipment and accessories that were previously removed.

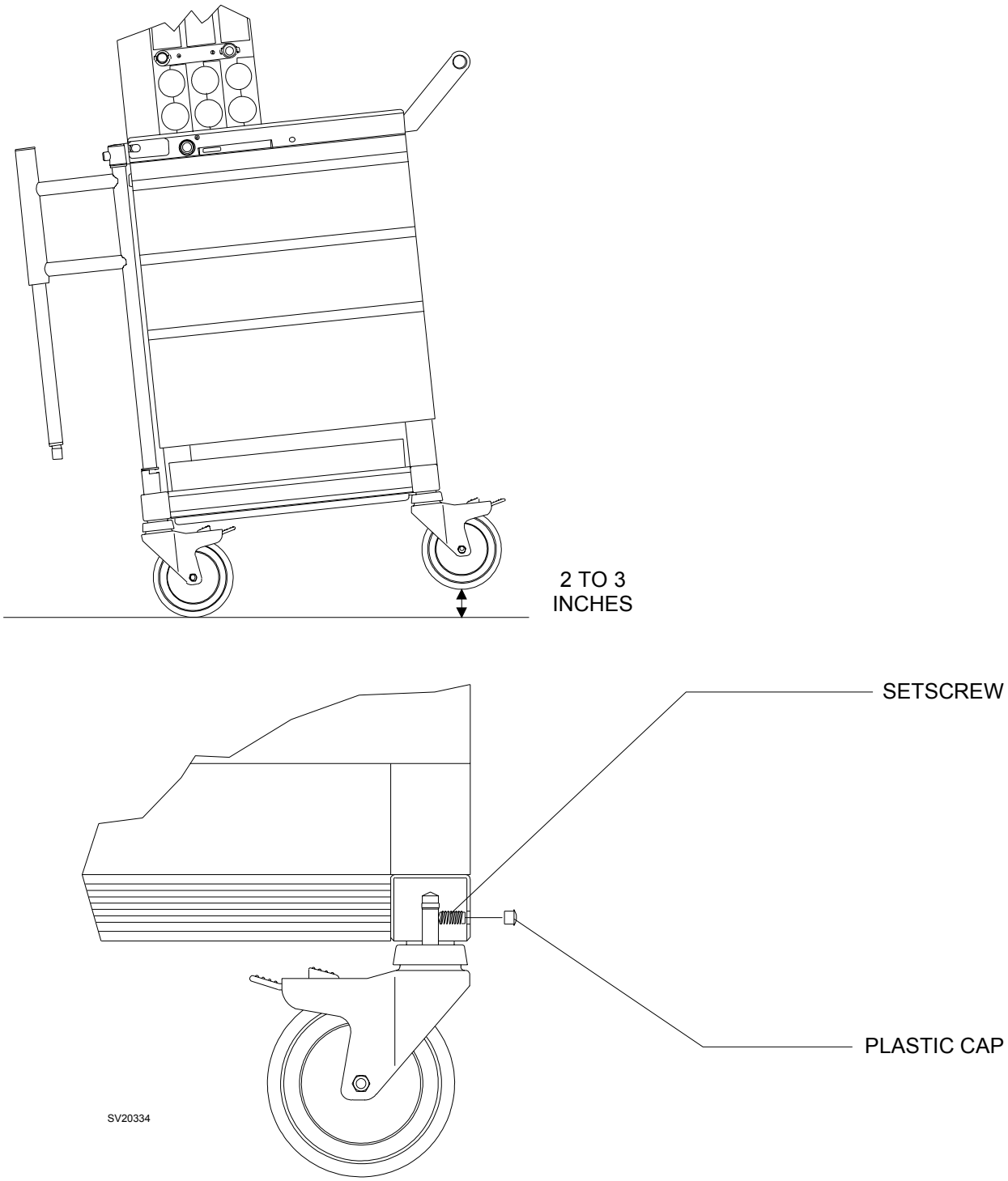


Figure 4-15. Caster Replacement

4.16 Battery (machines with power supply on back of machine)

The backup battery is located in the bottom of the power supply compartment on the back of the machines. Access to the battery requires removal of the power supply compartment cover. Figure 4-16 shows the battery connection and mounting arrangement.

4.16.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.16.2 Disable the circuit breakers on the back panel by pulling out each button with a knife or sharp object.

WARNING:Ensure that AC power is removed from the machine before opening the power supply compartment cover. Failure to observe this precaution may cause injury by electric shock.

4.16.3 Remove the screws holding the power supply compartment cover, and remove the cover.

4.16.4 Loosen the captive mounting screw holding the battery retainer bar, and remove the retainer bar.

4.16.5 Disconnect the battery wire harness from the battery terminals. Note the wire color and position of the wires so that the harness can be reinstalled in the same manner.

4.16.6 Remove the battery from the compartment.

4.16.7 Ensure that the replacement battery is wrapped in a protective bag in the same manner as the original.

Place the replacement battery in the compartment, with the terminals oriented as shown in the illustration.

4.16.8 Reinstall the battery retainer bar by placing its tab through the slot in the bracket, and tightening the captive mounting screw at the other end of the bar.

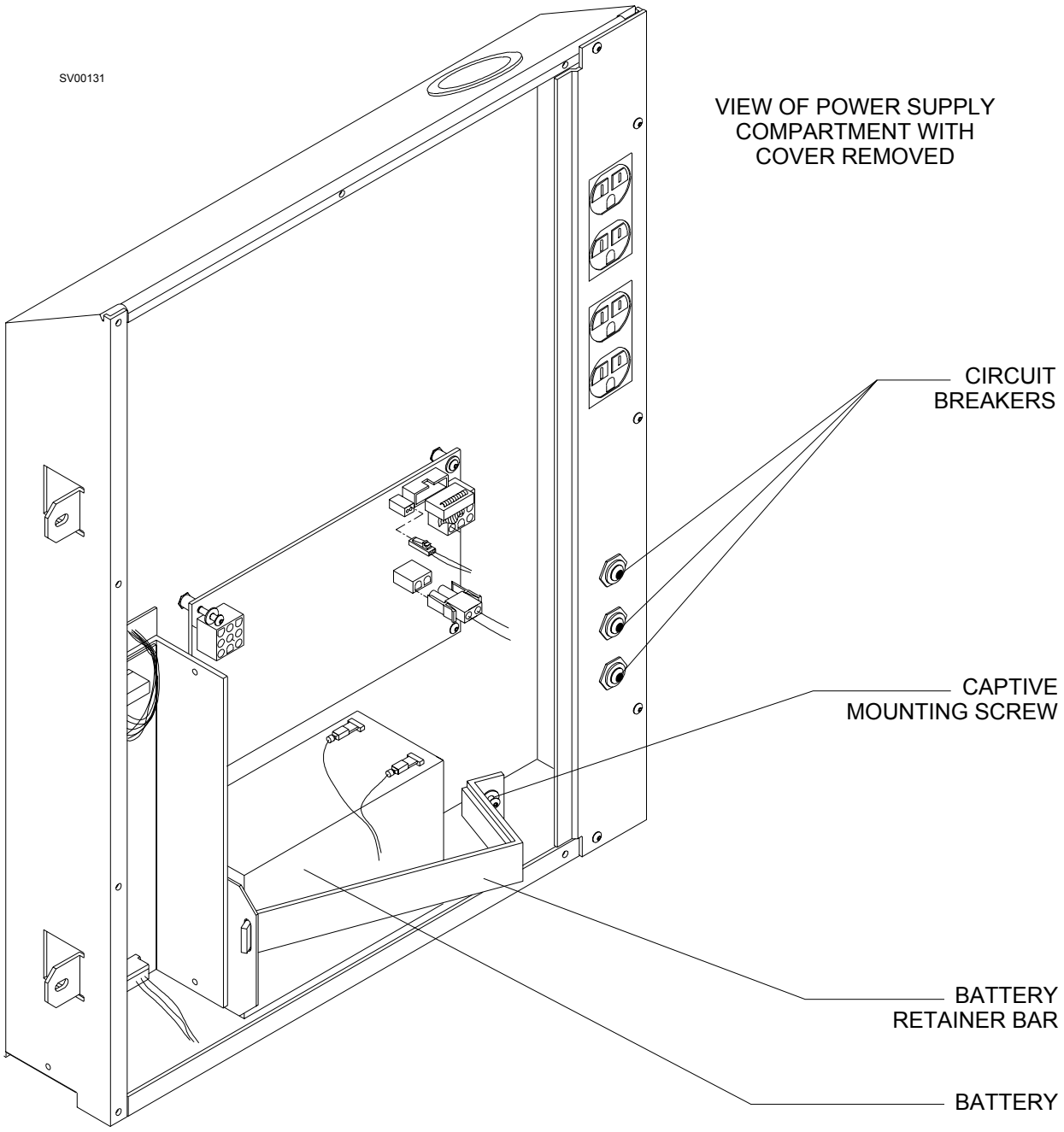


Figure 4-16. Battery Replacement

4.16.9 Connect the battery wire harness to the battery terminals with the black wire to the (-) terminal, and the yellow wire to the (+) terminal.

4.16.10 Reinstall the power supply compartment cover with the screws that were previously removed.

4.16.11 Enable the circuit breakers and restore power to the machine.

4.16.12 Perform the PMC Procedure given in Section 6.

4.16A Battery (machines with power supply in display box)

The backup battery is attached to the power supply assembly which is located in the display box. Access to the battery requires removal of the top cover of the machine and and removal of the power supply assembly. Figure 4-16A shows the battery connection and mounting arrangement.

4.16A.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.16A.2 Disable the battery circuit breaker (located on the underside of the display box) by pulling out the button with a knife or sharp object.

WARNING: Ensure that AC power is removed from the machine before removing the top cover. Failure to observe this precaution may cause injury by electric shock.

4.16A.3 Loosen the screws holding the top cover, disconnect the ground wire and remove the cover.

4.16A.4 Remove the display box back cover; loosen the captive mounting screws holding the power supply assembly, slide the assembly back until it can be tilted to gain access to all the battery retainer mounting screws.

4.16A.5 Disconnect the battery wire harness from the battery terminals.

4.16A.6 Remove the four screws securing the battery retainer, separate it from the power supply assembly and remove the battery.

4.16A.7 Ensure that the replacement battery is wrapped in a protective bag in the same manner as the original.

Install the battery with the terminals oriented as shown in the illustration, and secure its retainer with the hardware that was previously removed.

16A.8 Connect the battery wire harness to the battery terminals with the white/black wire to the (-) terminal, and the white/red wire to the (+) terminal as shown in the illustration.

4.16A.9 Reinstall the power supply assembly in the display box, and reinstall the back cover.

4.16A.10 Connect the ground wire and reinstall the top cover on the machine.

4.16A.11 Enable the circuit breaker and restore power to the machine.

4.16A.12 Perform the PMC Procedure given in Section 6.

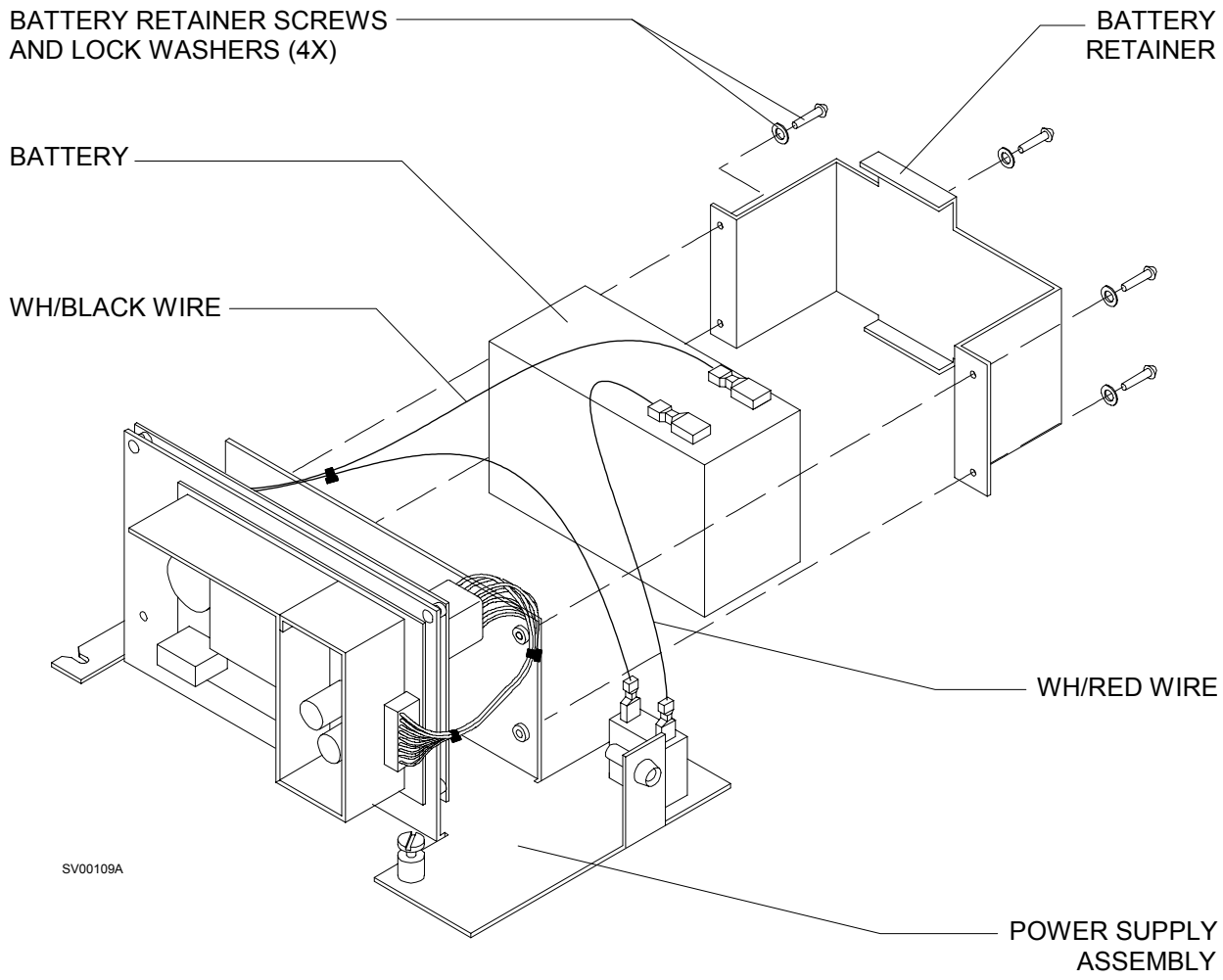


Figure 4-16A: BATTERY REPLACEMENT

4.17 Primary Power Supply

The primary power supply is located in the power supply compartment on the back of the machine. Access to the primary power supply requires removal of the power supply compartment cover. Figure 4-17 shows the primary power supply connection and mounting arrangement.

4.17.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.17.2 Disable the circuit breakers on the side of the power supply compartment by pulling out each button with a knife or sharp object.

WARNING:Ensure that AC power is removed from the machine before opening the power supply compartment cover. Failure to observe this precaution may cause injury by electric shock.

4.17.3 Remove the screws holding the power supply compartment cover, and remove the cover.

4.17.4 Disconnect the input wire harness from J1 on the power supply, and disconnect the output wire harness from J3.

4.17.5 Loosen the captive mounting screw holding the battery retainer bar, and remove the retainer bar.

4.17.6 Remove the four nuts holding the mounting plate bracket and power supply to the back of the compartment, and remove the assembly from the compartment.

4.17.7 Separate the power suply from the mounting plate bracket by removing the four retaining screws from the back of the plate.

4.17.8 Install the replacement power supply on the mounting plate bracket using the hardware removed in the previous step.

4.17.9 Reinstall the mounting plate bracket in the power supply compartment with the four nuts that were previously removed.

4.17.10 Reinstall the battery retainer bar and tighten its captive mounting screw.

4.17.11 Connect the output wire harness to J3 on the power supply, and the input wire harness to J1.

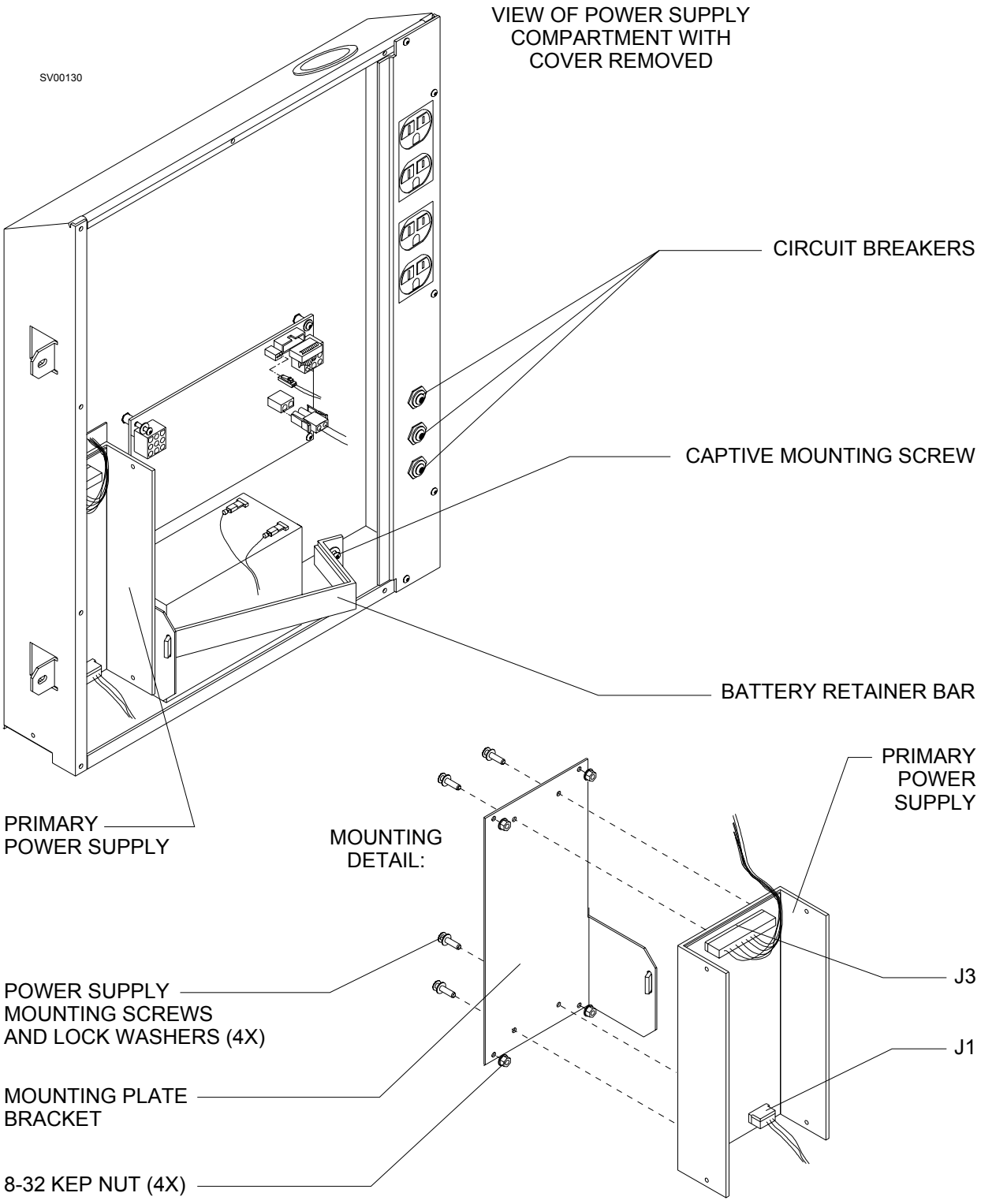


Figure 4-17. Primary Power Supply Replacement

4.17.12 Reinstall the power supply compartment cover with the screws that were previously removed.

4.17.13 Enable the circuit breakers and restore power to the machine.

4.17.14 Perform the PMC Procedure given in Section 6.

4.18 Power Supply PCB

The power supply PCB is located in the power supply compartment on the back of the machine. Access to the power supply PCB requires removal of the power supply compartment cover. Figure 4-18 shows the power supply PCB connection and mounting arrangement.

4.18.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.18.2 Disable the circuit breakers on the side of the power supply compartment by pulling out each button with a knife or sharp object.

WARNING:Ensure that AC power is removed from the machine before opening the power supply compartment cover. Failure to observe this precaution may cause injury by electric shock.

4.18.3 Remove the screws holding the power supply compartment cover, and remove the cover.

4.18.4 Disconnect the following from the power supply PCB:

J1: Output wire harness to processor PCB
J2: Ribbon cable from alarm channel PCB
J5: Power ON indicator lamp
J6: Battery wire harness
J3: Wire harness from primary power supply

4.18.5 Remove the four screws and lock washers holding the power supply PCB, and remove the assembly.

4.18.6 Install the replacement power supply PCB assembly using the hardware removed in the previous step.

4.18.7 Re-connect the cables and wire harnesses that were previously disconnected.

4.18.8 Reinstall the power supply compartment cover with the screws that were previously removed.

4.18.9 Enable the circuit breakers and restore power to the machine.

4.18.10 Perform the PMC Procedure given in Section 6.

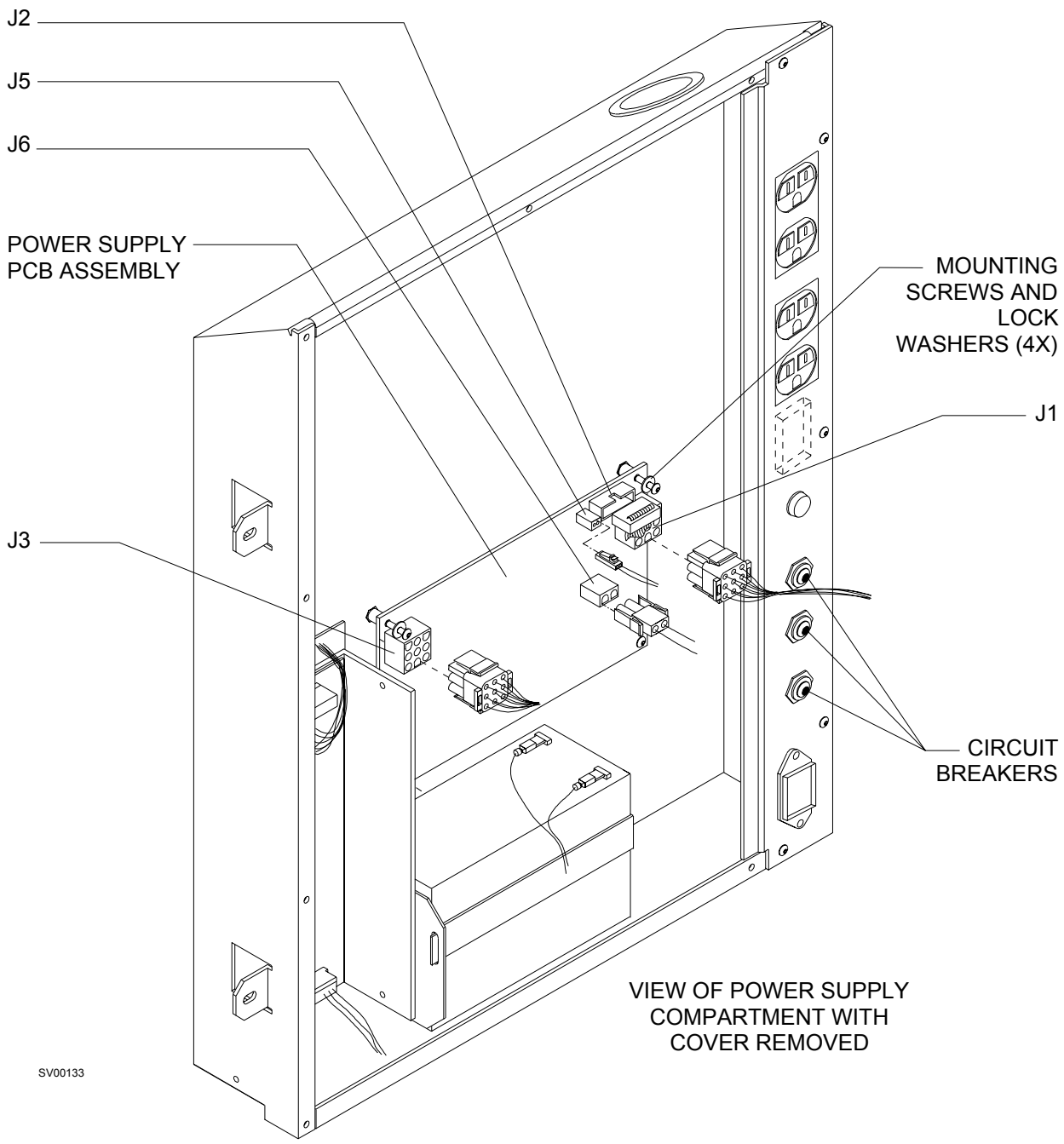


Figure 4-18. Power Supply PCB Assembly Replacement

4.18A Power Supply Assembly (machines with power supply in display box)

The power supply assembly is located in the display box and comprises the primary power supply, PCB assembly, battery, battery circuit breaker and power on indicator lamp. Access to the assembly requires removal of the top cover of the machine. Figure 4-18A shows the power supply connection and mounting arrangement.

4.18A.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.18A.2 Disable the battery circuit breaker (located on the underside of the display box) by pulling out the button with a knife or sharp object.

WARNING: Ensure that AC power is removed from the machine before removing the top cover. Failure to observe this precaution may cause injury by electric shock.

4.18A.3 Loosen the screws holding the top cover, disconnect the top cover ground wire and remove the cover.

4.18A.4 Remove the back cover from the display box.

4.18A.5 Disconnect the following:

AC power cable from J1 on power supply
Processor power wire harness from J1 on power supply PCB
Alarm channel ribbon cable from J2 on power supply PCB
Power supply ground wire from display box

4.18A.6 Loosen the two captive mounting screws on the power supply assembly, slide the assembly back until it is clear of the shoulder screws, then lift the assembly from the display box.

4.18A.7 Position the replacement assembly in the display box; slide it into place and then tighten the captive mounting screws.

4.18A.8 Reconnect the ground wire and cables that were previously disconnected.

4.18A.9 Reinstall the back cover on the display box.

4.18A.10 Connect the top cover ground wire and reinstall the top cover on the machine.

4.18A.11 Enable the battery circuit breaker and restore power to the machine.

4.18A.12 Perform the PMC Procedure given in Section 6.

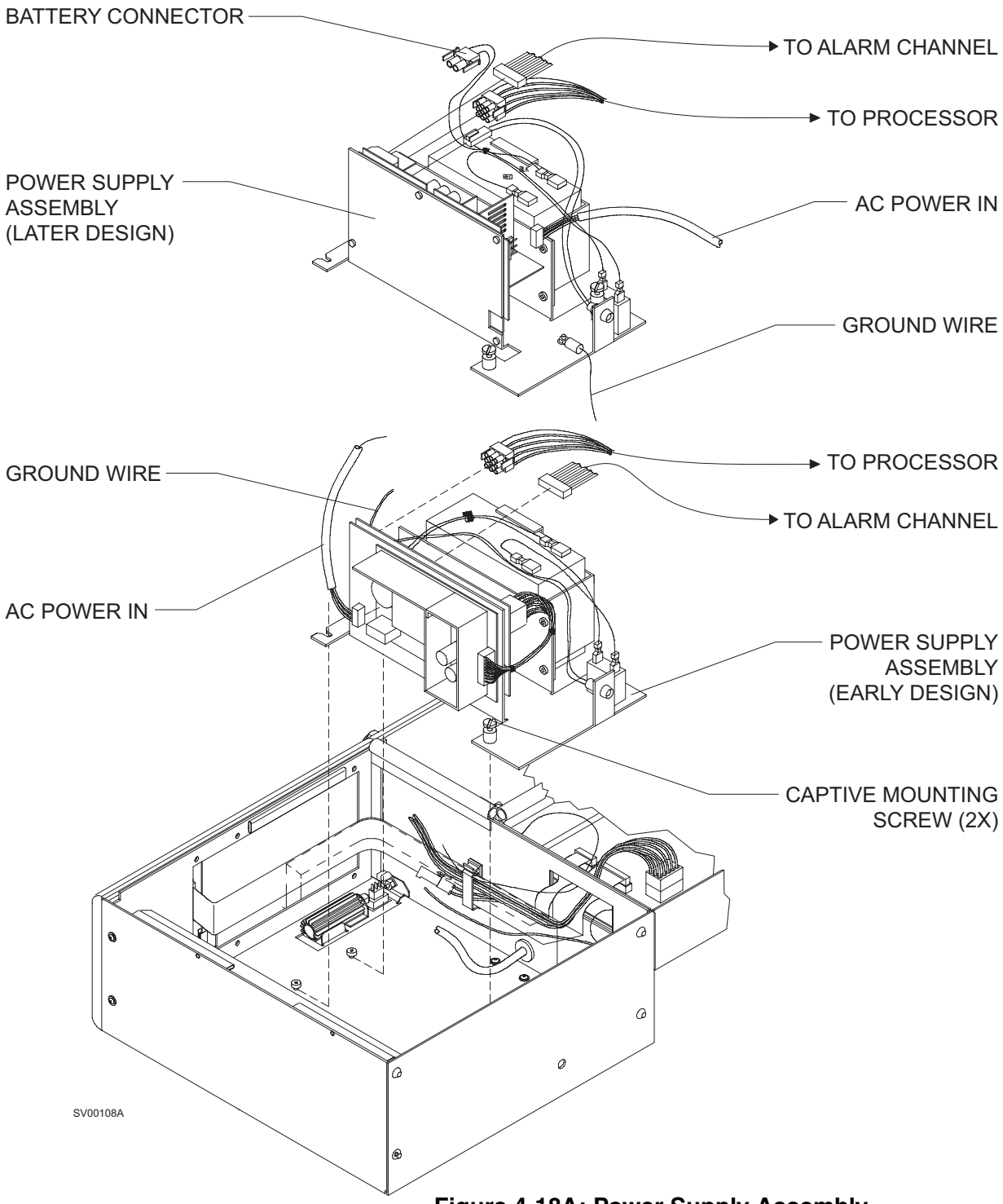


Figure 4-18A: Power Supply Assembly

4.19 Lamp Assembly

The lamp assembly contains a 12V lamp, rocker switch and wire harness as shown in Figure 4-19. The tab on the left side of the assembly fits into a rectangular opening in the underside of the display assembly, and the lamp assembly is retained by a single screw.

4.19.1 Turn the System Power switch to STANDBY.

4.19.2 Remove the lamp assembly retainer screw; lower and turn the assembly to remove it from the opening in the bottom of the display assembly.

4.19.3 Carefully separate the in-line connector on the wire harness.

NOTE: The next four steps apply if you are replacing the bulb (and not the entire assembly).

CAUTION: Do not touch the glass envelope of the bulb, as finger oil will damage the bulb.

4.19.4 Firmly grasp the lamp assembly, and slide the black heat sink from the assembly.

4.19.5 Remove the bulb by sliding it out of the socket.

4.19.6 Install the replacement bulb in the socket in the same manner as the original.

4.19.7 Reinstall the lamp heat sink.

4.19.8 Join the connector on the replacement lamp assembly to the wire harness on the machine.

4.19.9 Install the replacement lamp assembly in the underside of the display assembly by inserting the tab into the opening, then raise the lamp assembly into position and reinstall the retainer screw.

4.19.10 Turn the System Power switch to ON and verify that the lamp is working properly.

4.19.11 Perform the PMC Procedure given in Section 6.

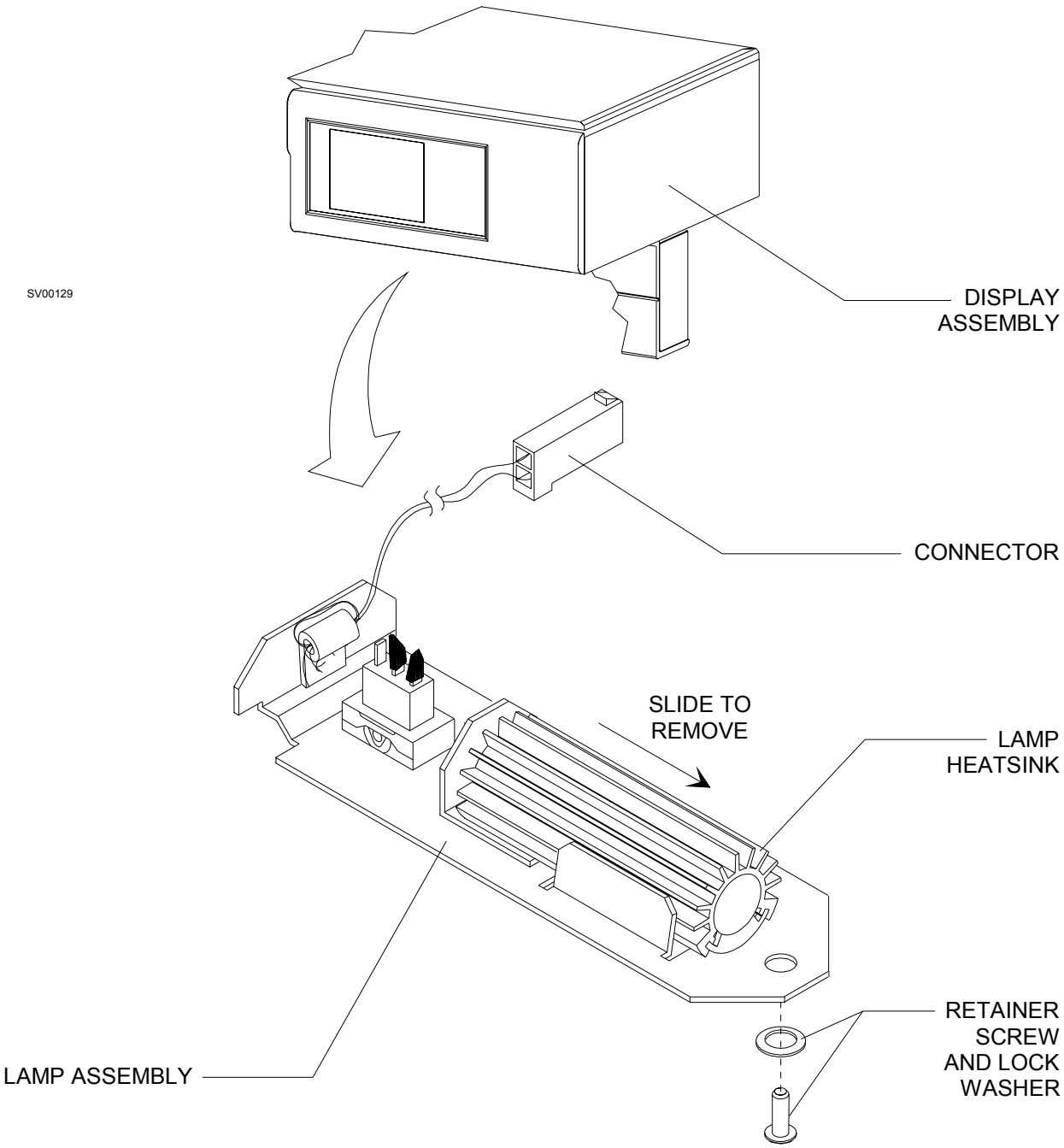


Figure 4-19. Lamp Assembly Replacement

4.20 Processor Assembly

Access to the processor assembly requires removal of the vent box back panel, and removal of the processor mounting screws. The assembly can then be pulled out for access to the cables. Figure 4-20 shows the mounting arrangement and cable connections to the processor board.

4.20.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.20.2 Disconnect the following items from their connectors at the underside of the vent box:

Data cable
Volume sensor interface cable
O_2 sensor interface cable
Breathing pressure line (quick-disconnect fitting)

CAUTION: The processor board contains static sensitive devices. Use ESD protection when handling the processor assembly.

4.20.3 Remove the vent box back panel screws.

4.20.4 At the underside of the vent box, remove the three screws holding the processor assembly to the vent box.

4.20.5 Pull the processor assembly outward and then down to gain access to its cables.

4.20.6 Disconnect the following from the processor board:

J104:Vaporizer select switch wire harness
J105:Alarm channel ribbon cable
J14: Power supply wire harness
J4: Keypad ribbon cable
J204:Display ribbon cable

4.20.7 Carefully remove the processor assembly from the vent box.

4.20.8 Inspect the jumper on JP6 (top PCB) on the replacement processor assembly and ensure it is installed on pins 5 and 6 before installing the processor assembly. This jumper is not placed on both pins of JP6 in order to prevent backup battery drain while the processor assembly is in stock.

NOTE: On later design boards this jumper is at JP2. See Figure 4-40A.

4.20.9 For machines with an ultrasonic flow sensor, there should be a jumper on Pins 1 & 2 at JP101 (see detail on Figure 4-20A). Remove this jumper if the machine has a Spiromed sensor.

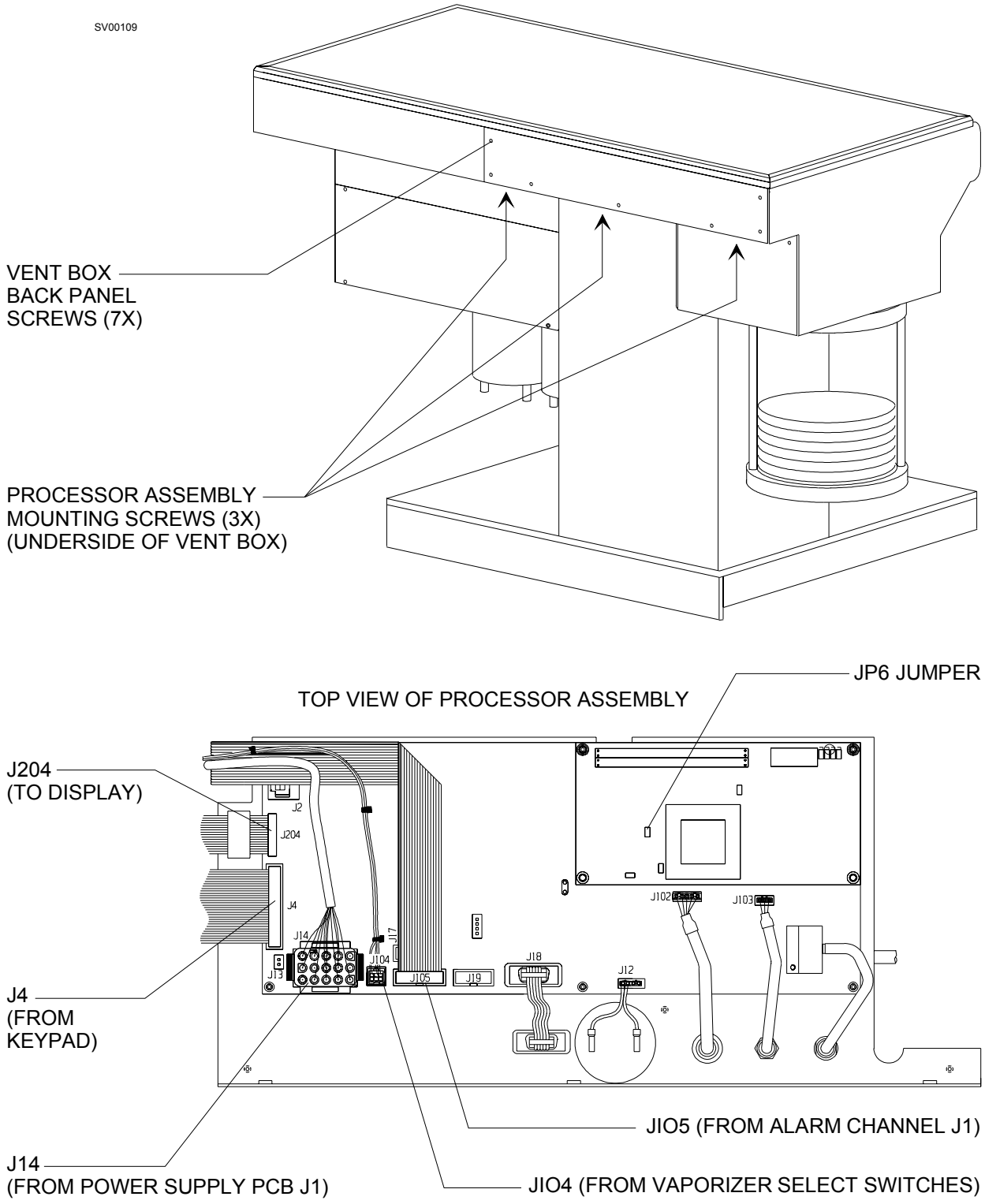


Figure 4-20. Processor Assembly Replacement (Early Design PCB Assembly Shown)

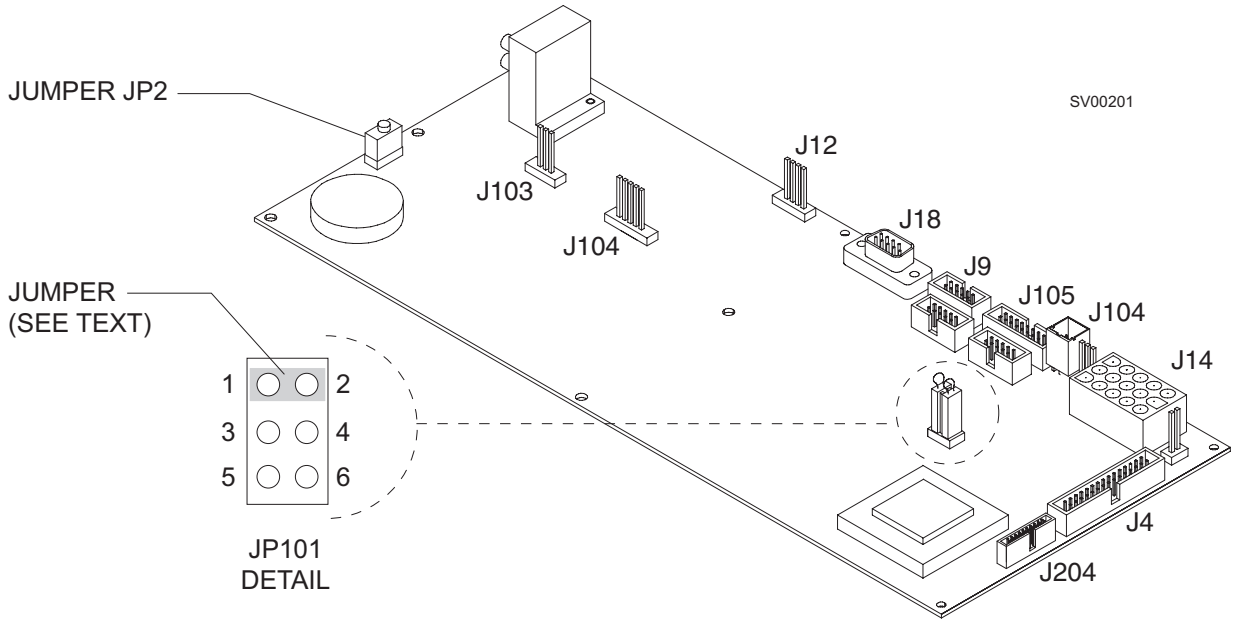


Figure 4-20A. Later Design PCB Assembly

4.20.10 Carefully position the replacement processor assembly in the vent box, and connect all of the cables previously disconnected.

4.20.11 Slide the processor assembly into the vent box, making sure that its back apron is under the vent box.

Reinstall the three processor assembly mounting screws up through the processor chassis and into the threaded inserts in the vent box.

4.20.12 Reinstall the vent box back panel with the screws that were previously removed.

4.20.13 Restore power to the machine and observe the Power-Up Diagnostic display (see Section 2) to verify that the replacement processor is working properly.

4.20.14 Access the secondary service screen and enter the machine serial number and vaporizer configuration into memory. Contact DrägerService for access instructions if necessary.

4.20.15 Perform the PMC Procedure given in Section 6.

4.21 Keypad and Display Panel

The keypad (switch panel) and display panel comprise a sandwich assembly held between the front bezel and a bezel plate on the back as shown in Figure 4-21. The keypad and the display panel are independently replaceable, as outlined in the following disassembly and re-assembly sequence.

4.21.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.21.2 Remove the bezel retainer screws at the right side of the display box.

4.21.3 Pull the right side of the bezel outward, slide it to the right until the locking tab on the left side of the bezel is clear of its receptacle, then pull the assembly out far enough to gain access to its connections.

4.21.4 Disconnect the ground wire and ribbon cables from the bezel assembly.

4.21.5 Remove the display panel cover from the back of the assembly.

4.21.6 Separate the bezel plate from the bezel by removing the four bezel plate screws, and lift out the keypad and display panel.

4.21.7 Remove the four nuts holding the display panel to the keypad, and remove the display panel.

NOTE: If you are replacing the keypad, transfer the spacers to the studs on the replacement keypad.

4.21.8 Assemble the keypad (or replacement keypad) and the display panel (or replacement display panel) using the nuts and lock washers that were previously removed.

4.21.9 Place the keypad and display panel into the bezel, and reattach the bezel plate using the screws and lock washers that were previously removed.

4.21.10 Reinstall the display panel cover using the screws and lock washers that were previously removed.

4.21.11 Re-connect the ribbon cables and ground wire.

4.21.12 Slide the bezel assembly into the display box, carefully fit the locking tab into its receptacle at the left side of the panel, and slide the assembly to the left until it is properly seated.

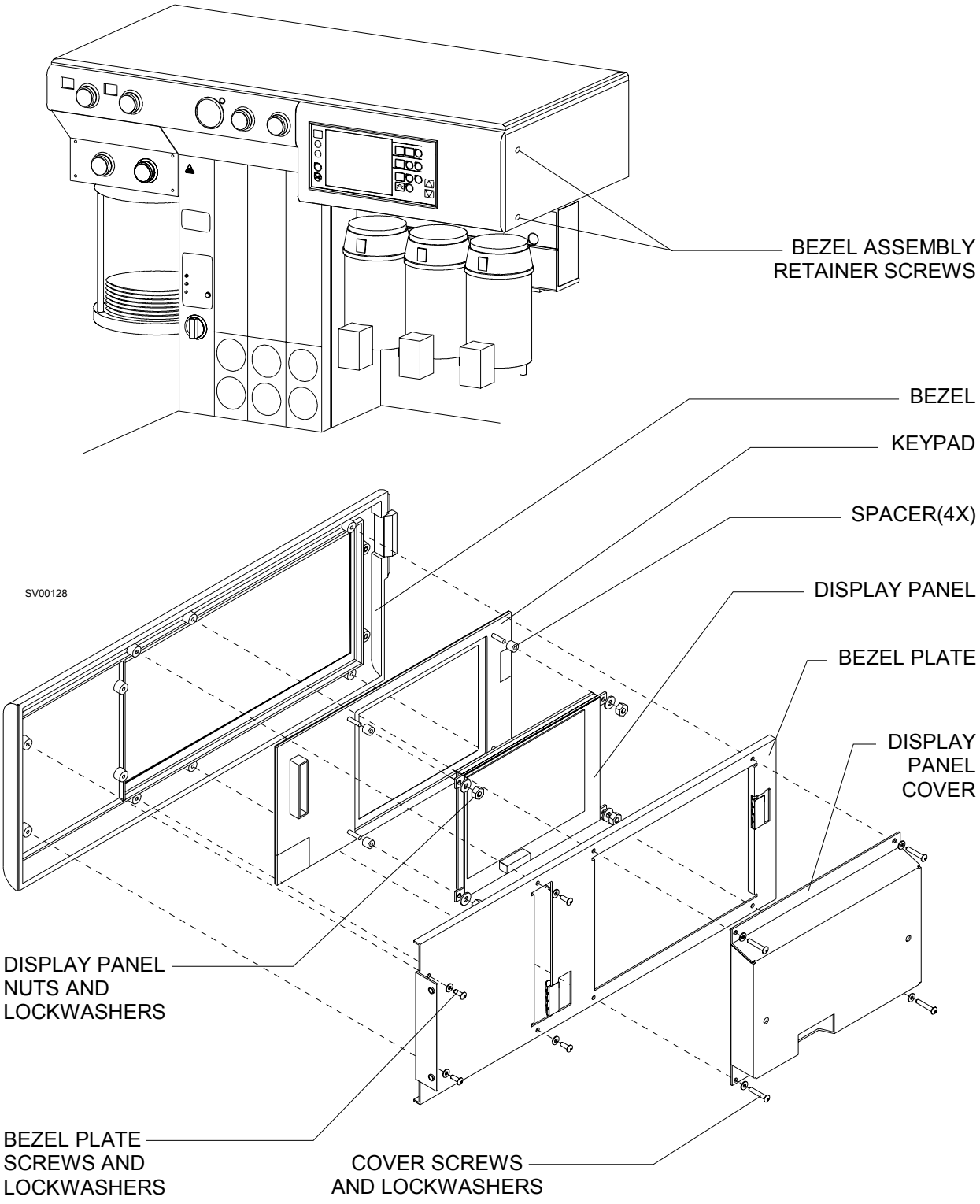


Figure 4-21. Keypad and Display Panel Replacement

4.21.13 Reinstall the bezel assembly retaining screws at the right side of the display box.

4.21.14 Perform the PMC Procedure given in Section 6.

4.22 SPIROMED Respiratory Volume Sensor

The respiratory volume sensor is installed between the top of the absorber assembly and the expiratory valve. Figure 4-22 shows the volume sensor mounting and gasket arrangement, and its interface cable connection on the underside of the vent box.

4.22.1 Turn the System Power switch to STANDBY.

4.22.2 Disconnect the sensor plug from the volume sensor receptacle on the vent box.

4.22.3 Remove the expiratory valve by unscrewing the valve retaining nut.

4.22.4 Remove the volume sensor from the absorber assembly by unscrewing its retaining nut.

4.22.5 CAUTION:Do not twist the body of the sensor when loosening the retaining nut. Hold the sensor while loosening the retaining nut to prevent damage to the unit.

4.22.6 Install the replacement volume sensor on the absorber assembly. Ensure that the gasket is seated properly and hand tighten the retaining nut.

4.22.7 Install the expiratory valve on the sensor. Ensure that the gasket is seated properly and hand tighten the valve retaining nut.

4.22.8 Connect the sensor plug to the volume sensor receptacle on the vent box.

4.22.9 Restore power to the machine and perform the respiratory flow monitor calibration procedure given in Section 5.

4.22.10 Perform the PMC Procedure given in Section 6.

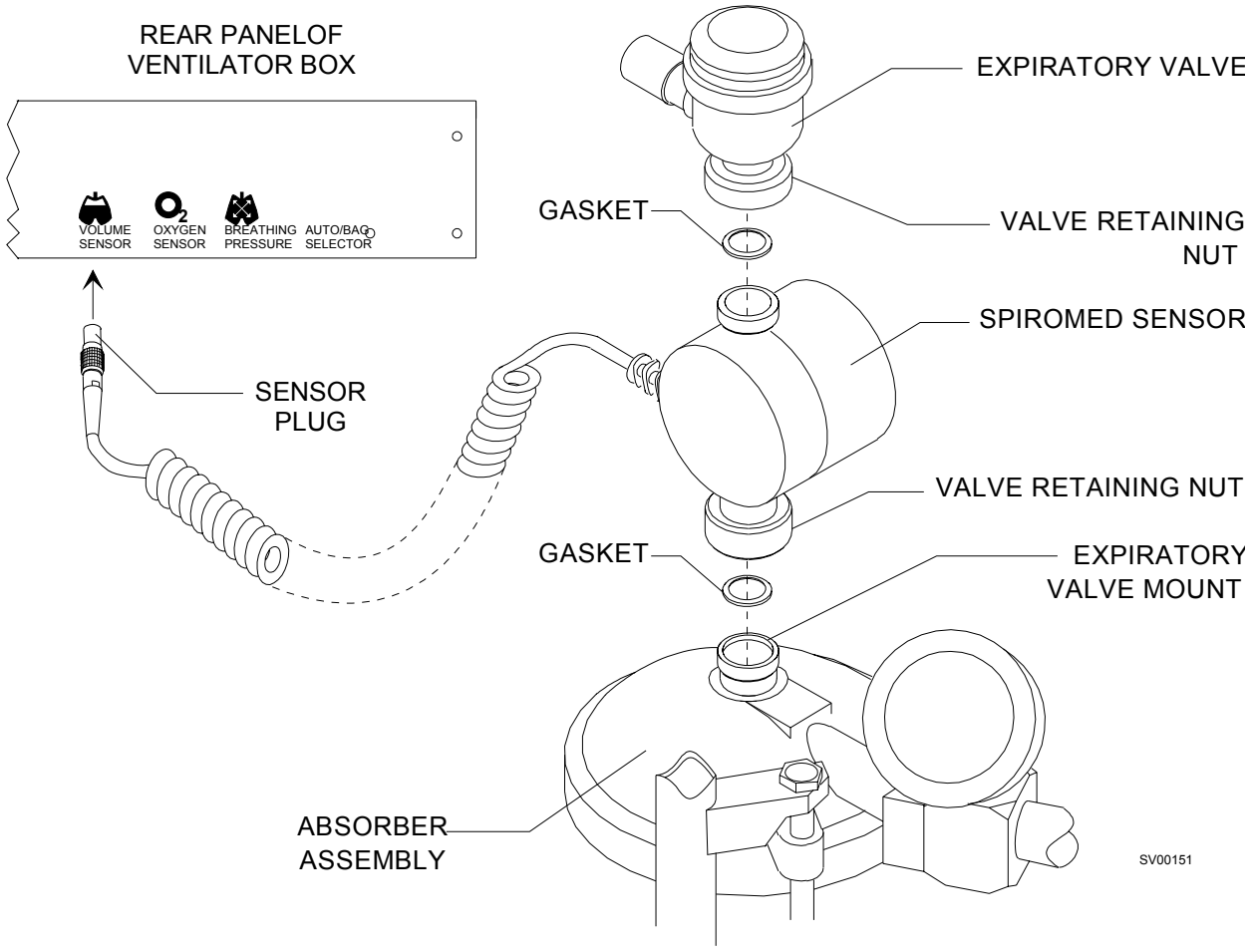


Figure 4-22. Respiratory Volume Sensor

4.23 Oxygen Sensor

The oxygen sensor is located on top of the inspiratory valve. Figure 4-23 shows the arrangement of the sensor capsule and its housing, and also its interface cable connection on the underside of the vent box.

4.23.1 Turn the System Power switch to STANDBY.

4.23.2 Pull the oxygen sensor housing from the inspiratory valve dome. (It is a press fit.)

4.23.3 Unscrew the cover from the sensor housing and remove the sensor capsule.

4.23.4 Remove the replacement sensor capsule from its shipping container and install it in the housing. Ensure that the copper rings on the capsule mate with the electrical contacts in the sensor housing.

4.23.5 Wait 15 minutes to allow the sensor capsule to stabilize.

4.23.6 Restore power to the machine and perform the 21% calibration procedure for the oxygen monitor given in Section 5.

4.23.7 Press the sensor assembly into the inspiratory valve dome.

4.23.8 Perform the PMC Procedure given in Section 6.

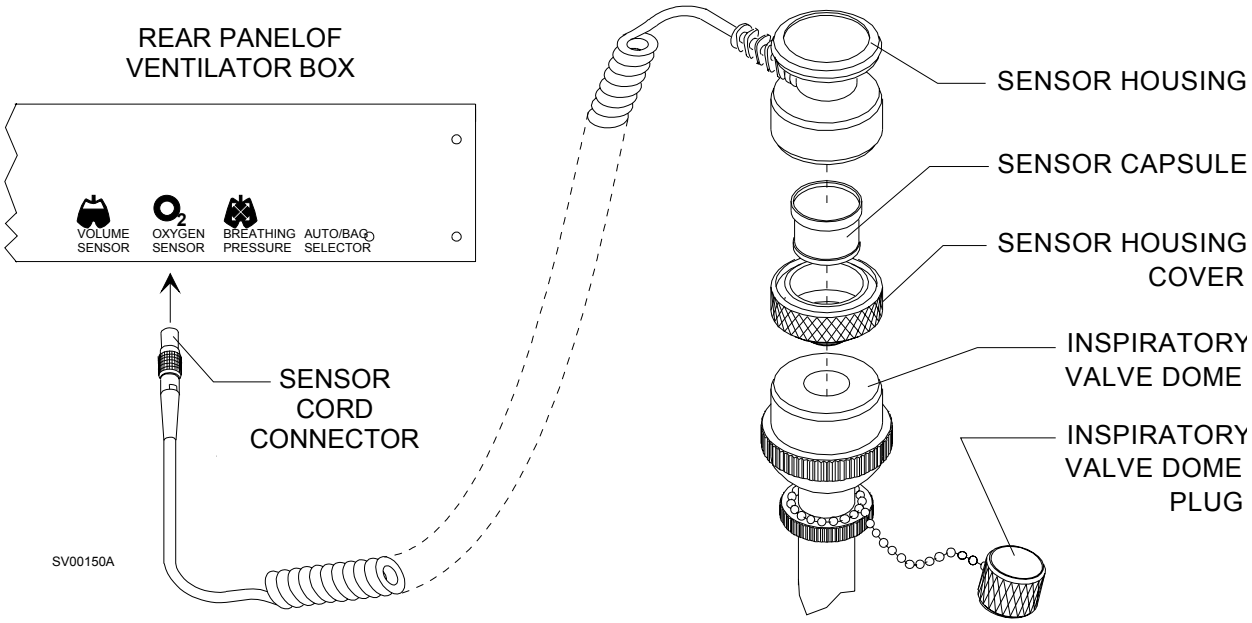


Figure 4-23. Oxygen Sensor Replacement

4.24 PEEP Valve Magnet Assembly Replacement

The PEEP valve magnet assembly removal and replacement is outlined in the following procedure. Figure 4-24 shows the knob and magnet assembly details.

NOTE: Some older PEEP valve assemblies require the use of a tamper-proof 5/64 hex key (P/N S010056).

4.24.1 Loosen the two set screws on the block, at each side of the PEEP knob using a 5/64 hex key. Back these screws out until they are flush with the block to allow proper removal of the knob assembly.

4.24.2 Using a flat head screw driver, carefully pry the knob and magnet assembly away from the block, and remove the assembly.

4.24.3 Remove the four or six screws securing the retaining ring on the knob and magnet assembly, and remove the retaining ring.

4.24.4 Remove the magnet assembly from the knob and discard the magnet in an appropriate manner.

4.24.5 Insert the new magnet assembly into the knob.

On new style knobs, make sure the magnet's dowel pin engages the slots in the knob. If the magnet is not oriented correctly there will be freeplay in the knob before it turns the magnet.

4.24.6 Reinstall the retaining ring and secure it with the screws that were previously removed.

4.24.7 Turn the set screws into the PEEP block until you can just see them from the inside of the block.

4.24.8 Apply a thin coat of high vacuum grease to the O-rings on the magnet assembly to aid in its installation.

4.24.9 Align the holes of the magnet assembly with the set screw holes, and install the knob & magnet assembly into the PEEP block.

4.24.10 Slowly tighten the set screws. If the holes are lined up correctly, you will be able to tighten the set screws several turns until they stop. If you experience resistance, STOP tightening the set screw to prevent damage to the magnet assembly. Re-align the knob & magnet assembly and tighten the set screw correctly.

4.24.11 Perform the PMC procedure given in Section 6.

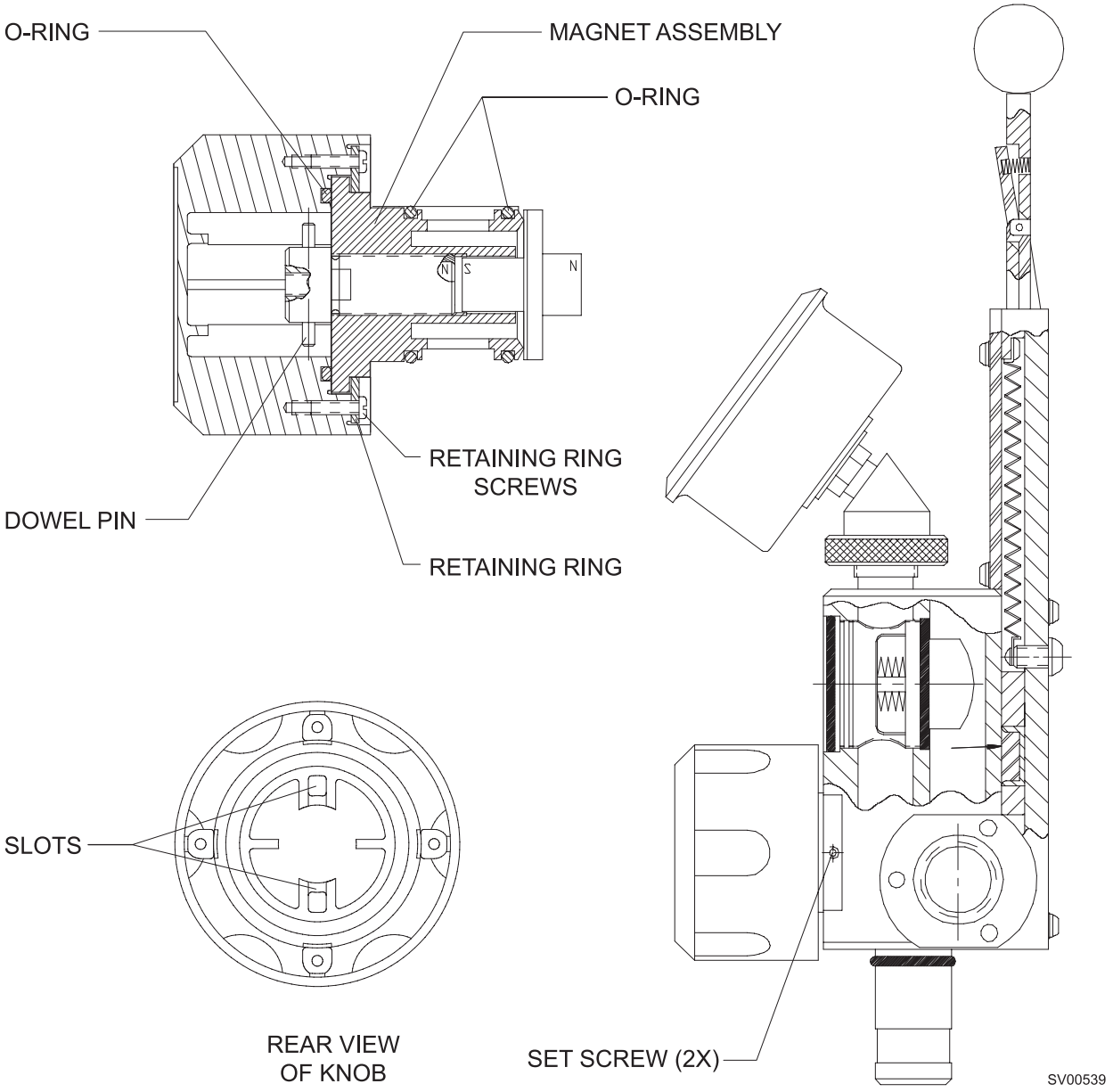


Figure 4-24. PEEP Valve Magnet Assembly Replacement

5.0 ADJUSTMENT AND CALIBRATION PROCEDURES

Equipment Required:

--Test Gauge for setting cylinder pressure regulators,

--Test Gauge for setting cylinder pressure regulators,

NAD Part No. S000063A

--Oxygen Monitor for adjusting Oxygen Ratio Controller

--Test fixture with breathing pressure line connector, TEE connector, gauge, and inflation device, for breathing pressure monitor calibration

--Exclusion system adjustment gauge (0.066 in.), NAD Part No. 4114238

5.1 Cylinder Pressure Regulator Adjustment (except CO2)

5.1.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.1.2 Close all cylinder valves except the O_2 valve.

5.1.3 Set the oxygen flow to 4 liters per min.

5.1.4 Open the other gas flow control valves to drain pressure from the system.

5.1.5 Close all of the flow control valves and press the O_2 Flush valve to drain oxygen pressure from the system.

5.1.6 Turn the System Power switch to STANDBY.

5.1.7 Loosen the screws holding the table top to the machine and lift out the table top.

5.1.8 Pull the writing tray out to its fully extended position.

NOTE: Minimum cylinder pressure for this adjustment shall be:
N2O & CO2: 600 psi; O2, Air, He, He/O2, N2: 1000 psi.

5.1.9 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

5.1.10 Connect a test gauge to the TEE fitting.

NOTE: For gases other than O2, the O2 cylinder valve must be open to allow other gases to flow. For N2O regulator adjustment, open the N2O flow control valve completely; then open the O2 flow control valve until the N2O flow reaches 4 L/min.

5.1.11 Open the cylinder valve and set the System Power switch to ON.

5.1.12 Set the O2 flow to 4 liters per min. (also set the N2O or other gas flow to 4 L/min. if these regulators are being adjusted).

5.1.13 Remove the acorn nut on the bottom of the regulator to expose the adjusting screw. For N2O, turn the screw until the test gauge indicates 46 psi (50 psi for CSA machines). For O2 and other gases, use the compensated regulator output setting based on the cylinder pressure given in the following table.

CAUTION: Based on information supplied by the cylinder regulator manufacturer, when the regulator is used for gases other than N2O or CO2, its output pressure will decrease 0.5 for every 100 psi increase in cylinder pressure above 1000 psi. Currently, these regulators are calibrated at 47 psi with a cylinder supply of 1000 psi. If a 2000 psi cylinder is then installed, the regulator output will be 42 psi. This change in output must be compensated for to provide accurate performance throughout the cylinder's working range.

NOTE: Cylinder pressure compensation for the N2O regulator is not required.

Cylinder Pressure (psi)	Compensated Regulator Output Setting (psi)	Compensated Regulator Output Tolerances (-4, +2)
2000	42 (*45)	38 - 44 (*41 - 47)
1800	43 (*46)	39 - 45 (*42 - 48)
1600	44 (*47)	40 - 46 (*43 - 49)
1400	45 (*48)	41 - 47 (*44 - 50)
1200	46 (*49)	42 - 48 (*45 - 51)
1000	47 (*50)	43 - 49 (*46 - 52)

* Canada Settings

NOTE: If the O2 cylinder regulator is adjusted according to the chart, perform the following test to verify that the Low O2 supply alarm is not activated during ventilation.

Open the O2 cylinder valve, install a breathing circuit with test lung to absorber, and make the following settings:

MAN/AUTO selector to AUTO

Ventilator:

FREQUENCY: 10 BPM
I:E Ratio: 1:2
Tidal Volume: 1400 mL
PLC: MAX
INSP FLOW: HIGH

Set the Fresh Gas flow to 10 L/min.

Turn on the ventilator. While the ventilator is cycling, press the O2 flush button and verify that the Lo O2 Supply alarm is not activated. If the alarm is activated, refer to Section 5.2 for Oxygen Supply Pressure Alarm Switch Adjustment.

5.1.14 Replace the acorn nut on the bottom of the regulator.

5.1.15 Close the cylinder valve and allow pressure to drain from the system.

5.1.16 Close all of the flow control valves and set the System Power switch to STANDBY.

5.1.17 Disconnect the test gauge from the TEE fitting and replace the plug in the fitting.

5.1.18 Replace the table top and tighten its retaining screws.

5.1.19 Connect the pipeline hoses.

5.1.20 Perform the PMC Procedure given in Section 6.

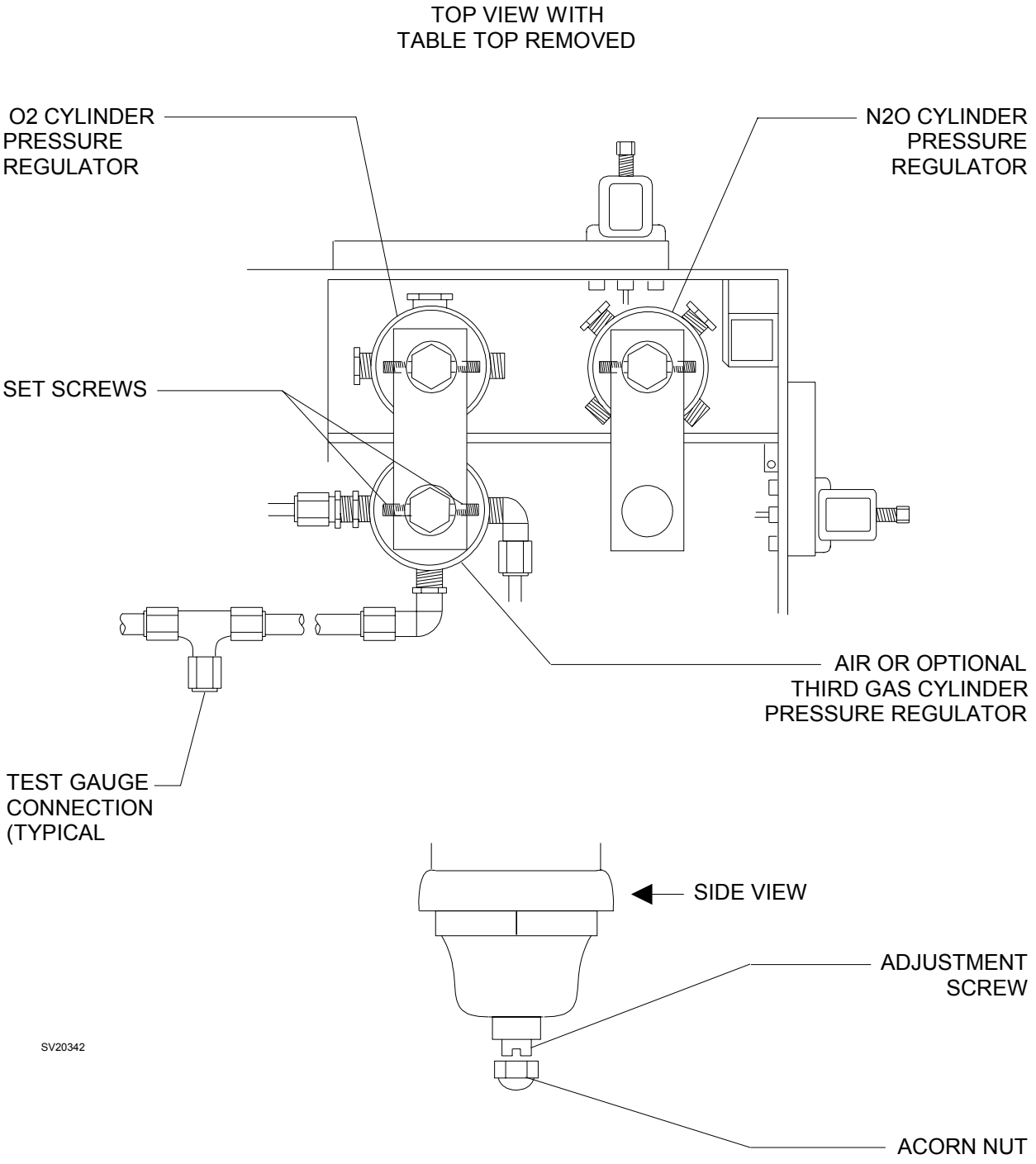


Figure 5-1. Cylinder Regulator Adjustment

5.1A CO2 Cylinder Pressure Regulator Adjustment

5.1.1.A Perform Steps 5.1.1 thru 5.1.7.

5.1.2.A Open the CO_2 cylinder valve and set the System Power switch to ON.

5.1.3.A Fully open the CO_2 flow control valve.

5.1.4.A Remove the acorn nut on the bottom of the CO_2 regulator to expose the adjusting screw. Turn the screw until the CO_2 flowmeter indicates 550 ml/min.

5.1.5.A Replace the acorn nut on the bottom of the regulator.

5.1.6.A Close the cylinder valve and allow pressure to drain from the system.

5.1.7.A Close the flow control valve and set the System Power switch to STANDBY.

5.1.8.A Replace the table top and tighten its retaining screws.

5.1.10.A Connect the pipeline hoses.

5.1.11.A Perform the PMC Procedure given in Section 6.

5.2 Oxygen Supply Pressure Alarm Switch Adjustment

5.2.1 Disconnect all pipeline hoses and set the System Power switch to ON.

5.2.2 Close all cylinder valves except the O_2 valve.

5.2.3 Set the oxygen flow to 5 liters per min.

5.2.4 Open the other gas flow control valves to drain pressure from the system.

5.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

5.2.6 Turn the System Power switch to STANDBY.

5.2.7 Remove the rear cover from the flowmeter housing. Remove the table top and pull the writing tray out to its fully extended position.

5.2.8 Locate the TEE fitting in the ¼ in. diameter regulator output line, and remove the plug from the TEE fitting.

5.2.9 Connect a dedicated O_2 test gauge to the TEE fitting.

5.2.10 Open the O_2 cylinder valve and turn the System Power switch to ON.

5.2.11 Set the oxygen flow to 5 liters per min.

5.2.12 Close the oxygen cylinder valve.

5.2.13 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

5.2.14 If the alarm activates when the pressure is below 34 psi or above 40 psi, turn the adjustment wheel (see illustration), repeat the test and adjust as necessary to bring the set point into the correct range.

5.2.15 Turn the System Power switch to STANDBY.

5.2.16 Disconnect the test gauge and replace the plug in the regulator line TEE fitting.

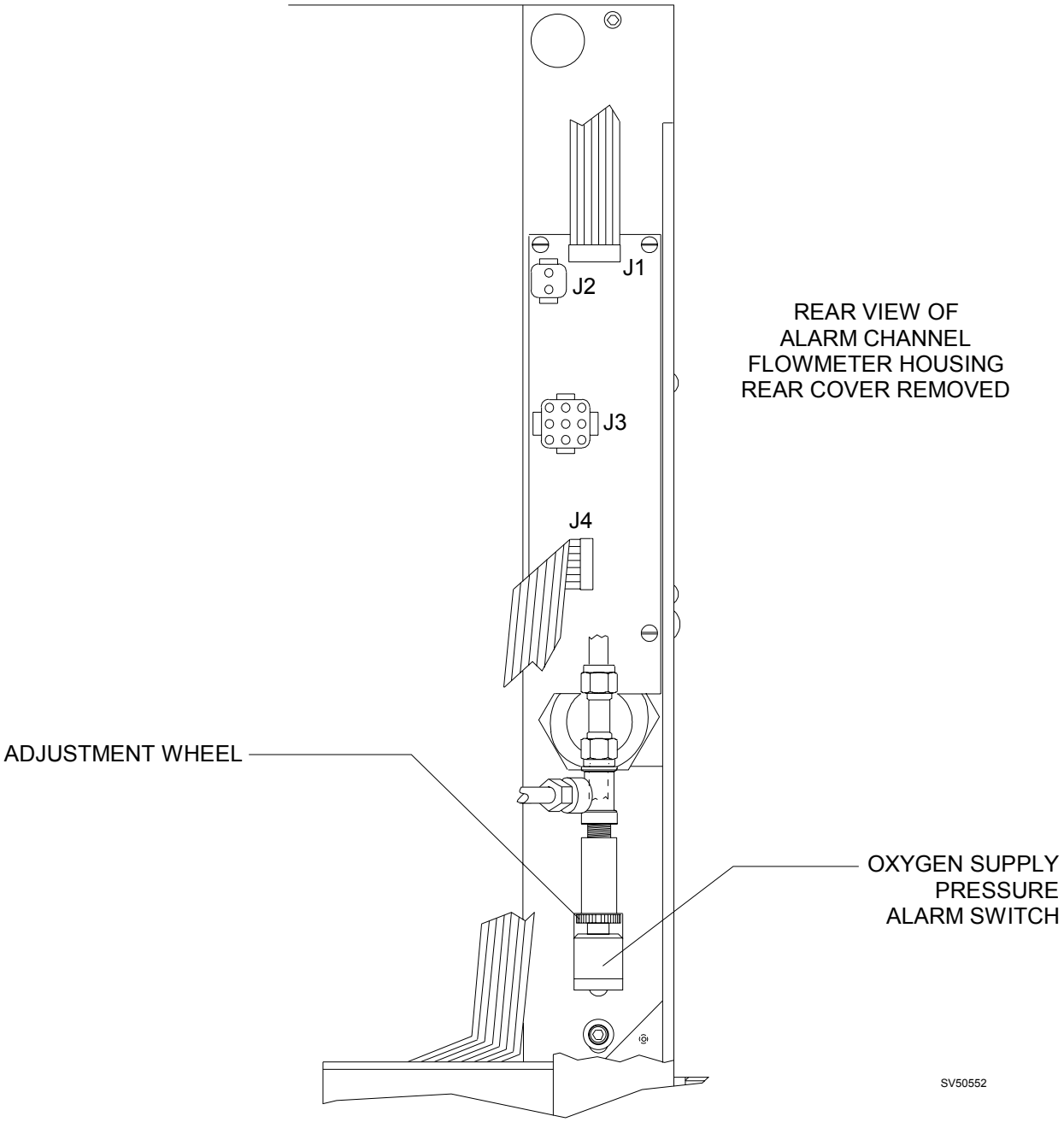


Figure 5-2. Oxygen Supply Pressure Alarm Switch

5.2.17 Replace the table top and tighten its retaining screws.

5.2.18 Replace the rear cover and its retaining screws.

5.2.19 Connect the pipeline hoses.

5.2.20 Perform the PMC Procedure given in Section 6.

5.3 Oxygen Ratio Controller (ORC) Adjustment

5.3.1 Remove the rear cover of the flowmeter housing.

5.3.2 Connect a calibrated oxygen monitor to the fresh gas outlet.

5.3.3 Disconnect the pipeline hoses.

5.3.4 Pinch the N_2O bypass line on the ORC. See Figure 5-3.

5.3.5 Open the oxygen and nitrous oxide cylinder valves.

5.3.6 Set the System Power switch to ON.

5.3.7 Close the O_2 and N_2O flow control valves.

5.3.8 Set the O_2 flow control valve to 10 l/min.

5.3.9 Set the N_2O flow control valve to 10 l/min.

5.3.10 Set the O_2 flow control valve to 800 ml/min for one (1) minute. Verify that the O_2 concentration indicates 21% to 29% O_2.

5.3.11 Decrease the oxygen flow rate.

5.3.12 If the nitrous oxide flow does not stop when the oxygen flow rate is between 325 and 350 ml per minute, loosen the adjusting screw locknut and turn the adjusting screw (counter-clockwise to decrease N_2O flow, clockwise to increase N_2O flow). Tighten the locknut.

5.3.13 Repeat steps 5.3.7 thru 5.3.12 until no further adjustment is needed.

5.3.14 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 10 liters per minute.

5.3.15 The oxygen concentration should be between 21% and 29% oxygen.

5.3.16 Slowly decrease the oxygen flow to 800 ml/min. The nitrous oxide flow should decrease proportionally, and the oxygen concentration should remain between 21% and 29% oxygen.

5.3.17 Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

5.3.18 The nitrous oxide flow should stop when the flow of oxygen is between 250 and 400 ml per minute.

5.3.19 Un-pinch the N_2O bypass line on the ORC.

5.3.20 Close the O_2 flow control valve, and fully open the N_2O flow control valve. Verify that the O_2 concentration is 22 - 31%.

5.3.21 Close the N_2O flow control valve and turn the System Power switch to STANDBY.

5.3.22 Reconnect the pipeline hoses.

5.3.23 Replace the flowmeter housing rear cover.

5.3.24 Perform the PMC Procedure given in Section 6.

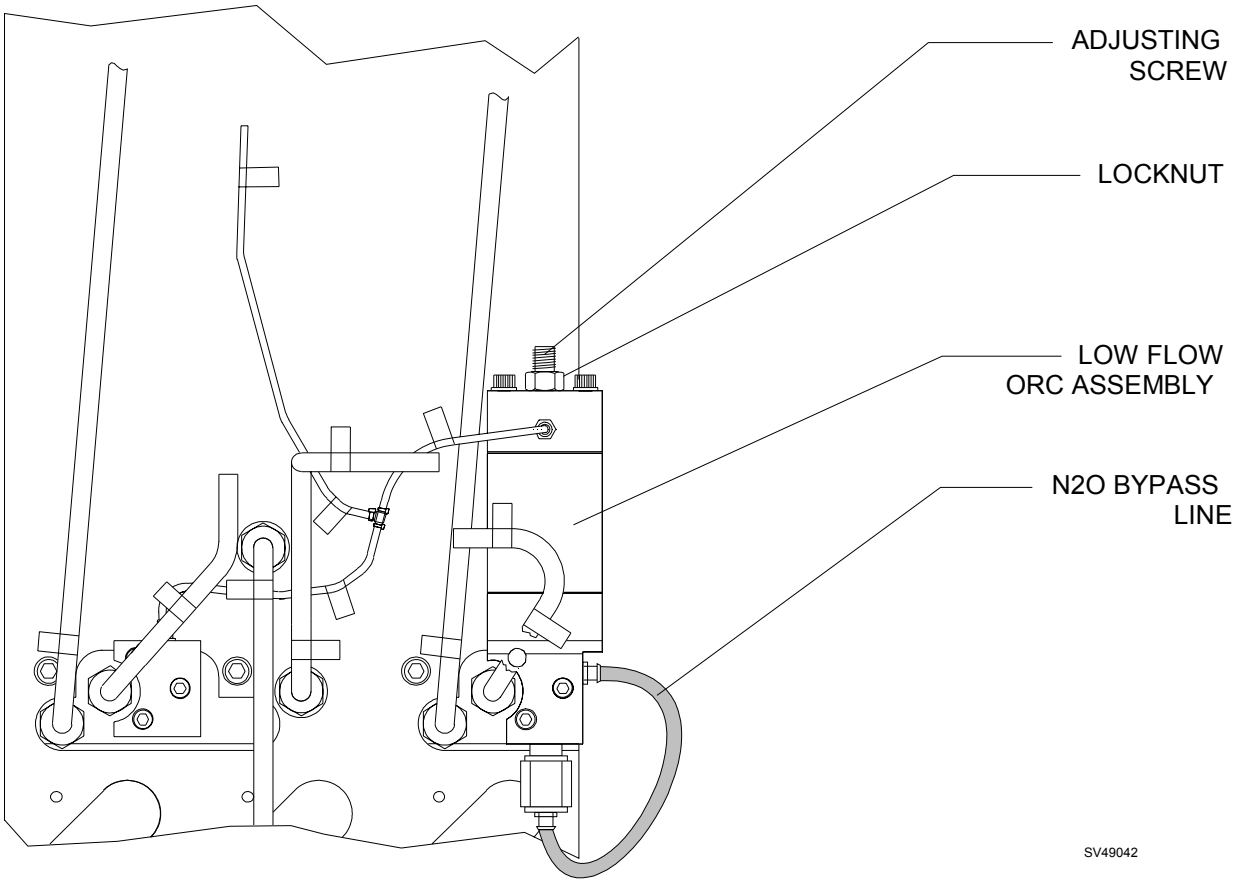


Figure 5-3. Oxygen Ratio Controller Adjustment

5.4 Oxygen Sensor Calibration

5.4.1 Turn the System Power switch to ON.

5.4.2 Enter the Main Service Screen and select the Service Mode (ref. Section 2).

5.4.3 Enter the Oxygen Monitor Service Screen.

5.4.4 Zero Calibration

5.4.4.1 Remove the oxygen sensor capsule from its housing and allow several minutes for the displayed offset readings to stabilize.

NOTE: The difference between the displayed CELL A and CELL B readings should be no greater than 8.

5.4.4.2 Press the key next to ZERO to store the current values as the new zero calibration.

5.4.4.3 Reinstall the sensor capsule in its housing.

5.4.5 21% Calibration

5.4.5.1 Expose the sensor to ambient air only (away from any open part of the breathing system) and allow it to stabilize for several minutes.

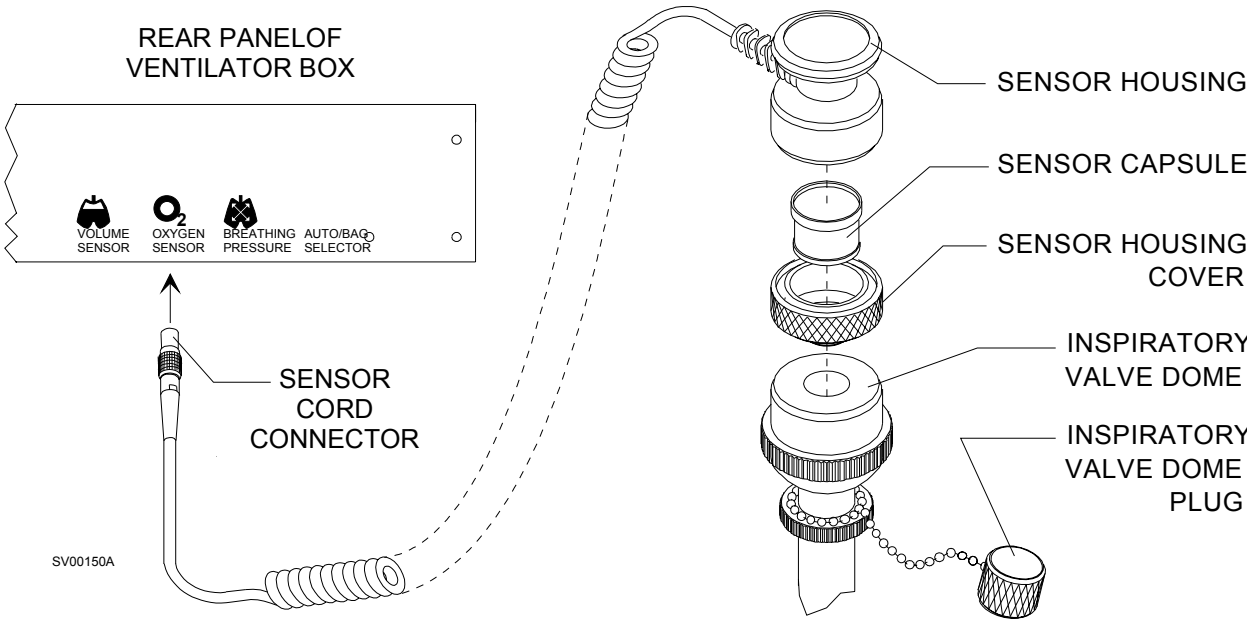
5.4.5.2 Press the key next to EXIT to return to the Main Service Screen. Press the key next to EXIT again to return the display to normal operation.

5.4.5.3 Press the CAL key to initiate the 21% O_2 calibration.

During calibration, the LED next to the CAL key lights, and the label CAL appears in the oxygen monitor window. Following successful calibration, the currently sensed oxygen concentration appears in the oxygen monitor window.

5.4.5.4 When calibration is complete, reinstall the sensor assembly in the inspiratory valve dome.

NOTE: If the O_2 sensor will not calibrate properly, refer to the Oxygen Monitoring section of the Narkomed GS *OPERATOR'S INSTRUCTION MANUAL* for further information.



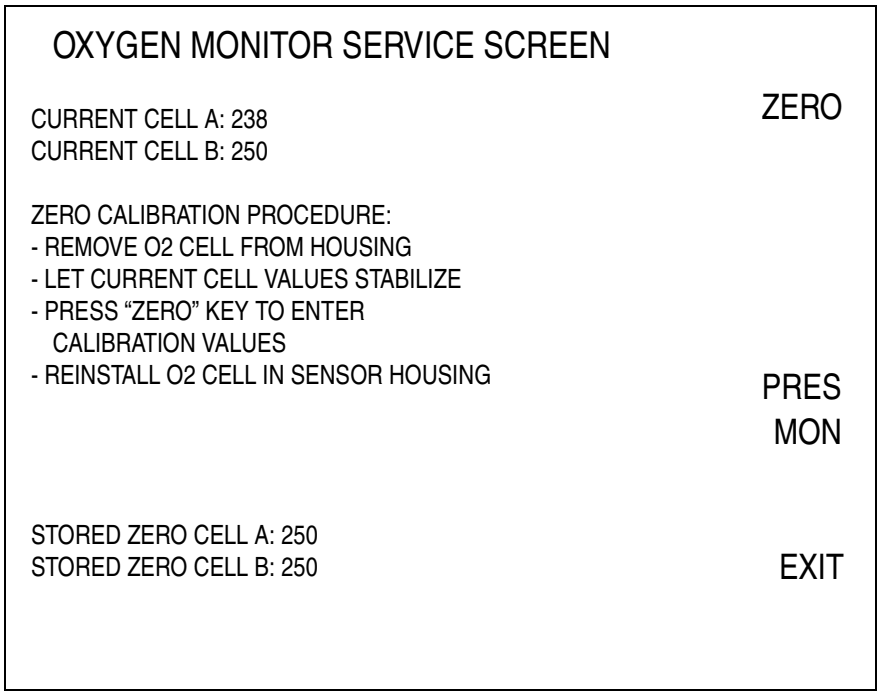

OXYGEN MONITOR SERVICE SCREEN
CURRENT CELL A: 238
CURRENT CELL B: 250
ZERO CALIBRATION PROCEDURE:
- REMOVE O2 CELL FROM HOUSING
- LET CURRENT CELL VALUES STABILIZE
- PRESS "ZERO" KEY TO ENTER
CALIBRATION VALUES
- REINSTALL O2 CELL IN SENSOR HOUSING
STORED ZERO CELL A: 250
STORED ZERO CELL B: 250
ZERO
PRES MON
EXIT

Figure 5-4. Oxygen Monitor Service Screen

5.5 Breathing Pressure Monitor Calibration

5.5.1 Turn the System Power switch to ON.

5.5.2 Enter the Main Service Screen and select the Service Mode (ref. Section 2).

5.5.3 Proceed to the Pressure Monitor Service Screen.

5.5.4 Zero Calibration

5.5.4.1 Disconnect the pressure sample line from the absorber and let the current pressure value stabilize.

5.5.4.2 Press the key next to ZERO to store the current value as the new zero.

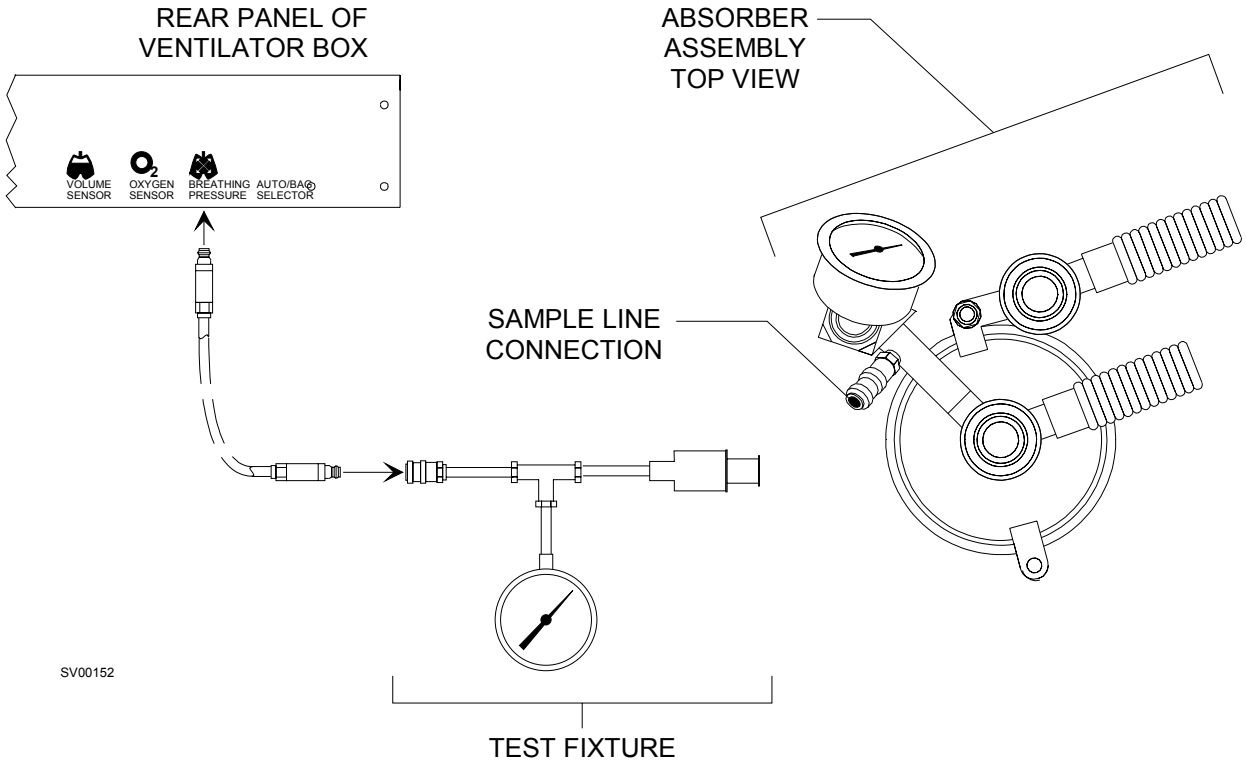
5.5.5 Span Calibration

5.5.5.1 With a test fixture connected as shown in Figure 5-6, apply a pressure of 50 cm H_2O to the pressure sample line.

5.5.5.2 When the displayed current value is stabilized, press the key next to SPAN to store the current value as the new span calibration.

5.5.6 Disconnect the test fixture.

5.5.7 Press the key next to EXIT to return to the Main Service Screen.



PRESSURE MONITOR SERVICE SCREEN

CURRENT PRESSURE VALUE: 250

ZERO CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER, EXPOSE TO AIR.
- LET CURRENT PRESSURE VALUE STABILIZE
- SELECT "ZERO" KEY TO ENTER CALIBRATION VALUES.

SPAN CALIBRATION PROCEDURE:
- REMOVE PRESSURE SAMPLE LINE FROM ABSORBER, APPLY 50 CMH2O CONSTANT PRESSURE AT THE SAMPLE LINE, VERIFIED BY A KNOWN, CALIBRATED METER.
- LET PRESSURE VALUE STABILIZE
- SELECT THE "SPAN" KEY TO ENTER THE CURRENT VALUE.

ZERO
SPAN
OXY MON
EXIT

Figure 5-5. Pressure Monitor Service Screen

5.6 Vaporizer Interlock Adjustment

The following procedure describes the interlock adjustment on a 3-vaporizer machine. The same principles apply on a 2-vaporizer machine.

5.6.1 Turn the System Power switch to STANDBY.

5.6.2 Remove the cover from the vaporizer interlock mechanism.

5.6.3 Turn the center vaporizer handwheel to an ON position.

5.6.4 Turn the center plunger adjustment screw until the distance between the plunger block and the small pins on the horizontal shafts is approximately 0.066 in. See Figure 5-6.

5.6.5 Set the left vaporizer handwheel to the center of its OFF position.

5.6.6 Turn the left vaporizer plunger adjustment screw until the bevel on the plunger block just touches the bevel on the horizontal shaft*. Once the bevels are touching, turn the adjustment screw counter-clockwise 1¼ turns.

5.6.7 Repeat Step 5.6.5 for the right vaporizer.

5.6.8 Repeat Step 5.6.6 for the right vaporizer.

5.6.9 Turn the center vaporizer handwheel to OFF.

5.6.10 Turn the left vaporizer handwheel to an ON position.

5.6.11 Repeat Step 5.6.5 for the center vaporizer.

5.6.12 Repeat Step 5.6.6 for the center vaporizer.

5.6.13 Turn the left vaporizer handwheel to OFF.

5.6.14 Set all the vaporizers to the extreme of their OFF position. Verify that each vaporizer can be turned on.

5.6.15 Verify that no more than one vaporizer can be turned on at a time.

5.6.16 Reinstall the cover over the vaporizer interlock mechanism.

5.6.17 Perform the PMC Procedure given in Section 6.

* Verify that the handwheel is still in the center of its OFF position.

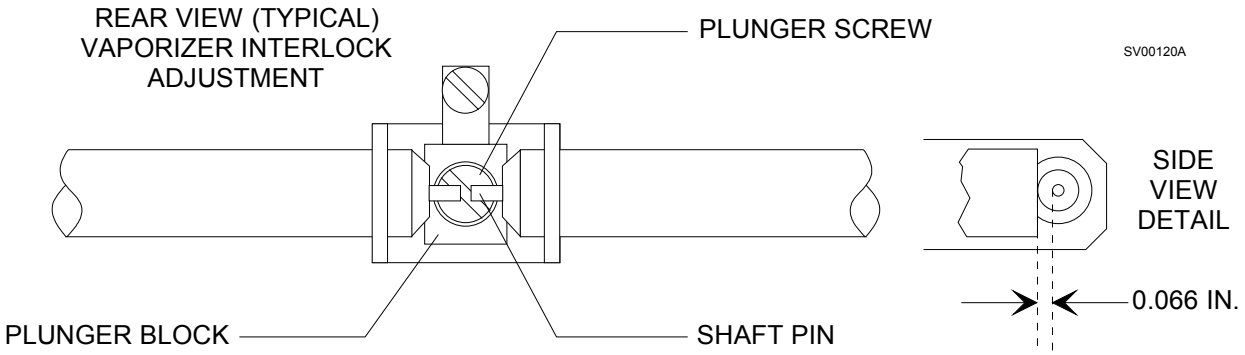


Figure 5-6. Vaporizer Interlock Mechanism

5.7 Vaporizer Select Switch Adjustment

5.7.1 Turn the System Power switch to STANDBY.

5.7.2 Remove the cover from the vaporizer interlock mechanism.

NOTE: The vaporizer handwheel must be in the zero or OFF position.

5.7.3 Turn the nylon actuator adjustment screw (see Figure 5-7) counter-clockwise several turns, or until it is no longer pushing the microswitch actuator.

5.7.4 Slowly turn the nylon screw clockwise until the microswitch is activated - as evidenced by an audible click; continue turning the nylon screw clockwise an additional two turns.

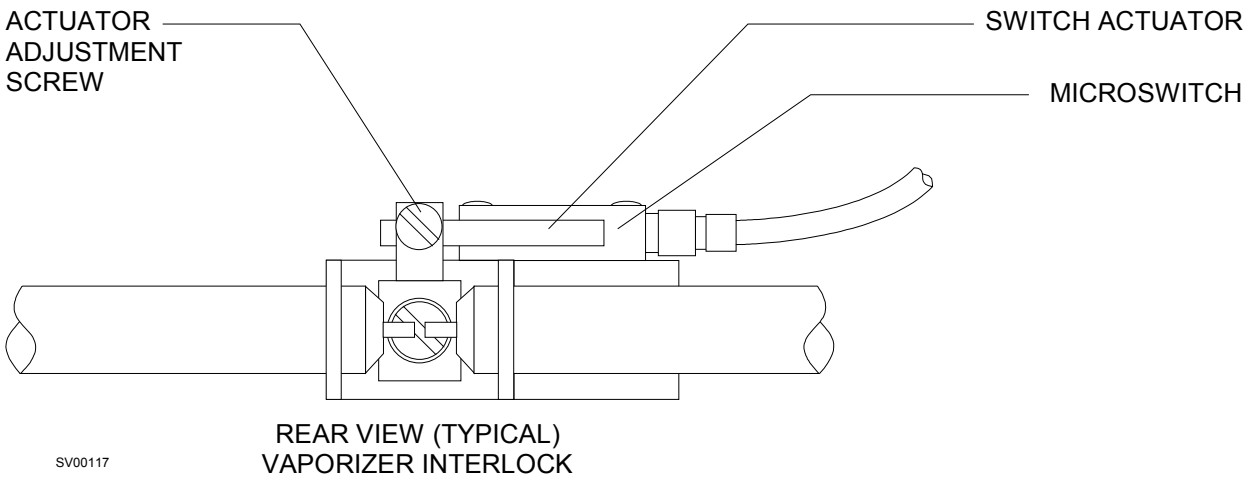


Figure 5-7. Vaporizer Select Switch Adjustment

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

6.0 PMC PROCEDURE, NARKOMED GS

The procedures in this section shall be performed in their entirety each time a component is removed, replaced, calibrated, adjusted and during all scheduled Periodic Manufacturer's Certification (PMC) visits. A PMC Checklist form, P/N S010211 is available from Draeger Medical, Inc. and shall be completed by the Technical Service Representative each time a PMC is performed. Steps in the procedure marked with (✓) require a response at the corresponding line on the checklist form.

Space is also provided on the PMC checklist form to record the results of a vapor concentration test. Refer to the current Anesthesia Equipment & Monitoring System Service Information CD-ROM Service Procedures section for vapor concentration verification procedures.

NOTE: Test equipment listed below with an asterisk (*) requires calibration at a maximum interval of one year. Verify the dates on test equipment calibration labels. DO NOT USE any test equipment having an expired calibration date. Notify your supervisor immediately if any equipment is found to be out of calibration. In the space provided at the bottom of the PMC checklist form, record the Model and ID number of all calibrated test equipment used.

In the space provided at the bottom of the PMC checklist form, record the Model and ID number of all calibrated test equipment used. Also record the calibration due dates. Examples are: multimeter, digital pressure meter, Riken gas analyzer, safety analyzer, volumeter, trace gas analyzer, simulators.

Test Equipment Required:

-- *Electrical Safety Analyzer (Biotek 501 Pro or equivalent)
-- *Pressure Gauge with DISS Adapters (P/N 4114807 or equivalent)
-- *Flowmeter 0-250 ml min. (P/N S000081 or equivalent)
-- *Volume Meter (P/N 2212300 or equivalent)
-- *Digital Pressure Manometer (SenSym PDM 200CD or Equivalent)
-- *Riken Gas Indicator (Model 18H, or 1802D or equivalent)
-- Stop Watch
-- Test Lung (P/N 8401892)
-- AC Receptacle Circuit Tester

Materials Required:

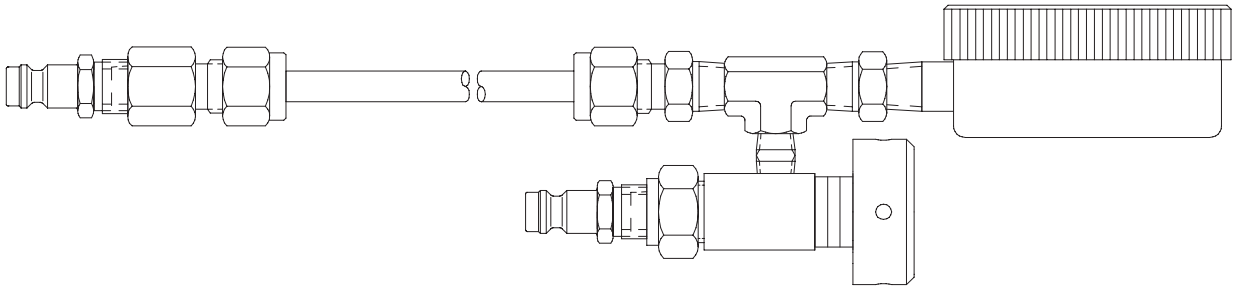
-- Spiromed Lubrication Kit (P/N 2218180)
-- Breathing Bag 3 liter (P/N 9995330 or equivalent)
-- Patient Circuit: Y-piece, elbow, 2x 32" x 22mm hoses
-- Hose 22 mm x 32" (P/N 9995132)
-- Fresh Gas Outlet Volume Test Device (P/N S010158 or equivalent)

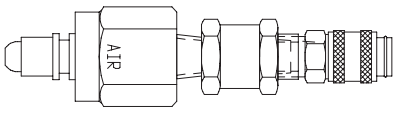
Materials Required (continued):

-- Fresh Gas Leak Test Adapter (P/N 4115041 or equivalent)
-- Volumeter/Fresh Gas Adapter (P/N 4115042)
-- Test Terminal 2x (P/N 4104389 or equivalent)
-- Breathing System Leak Test Device (P/N S010159 or equivalent)
-- PDM/Suction Adapter (P/N 4115038)
-- Scavenger Adapter (P/N 4108114)
-- NIBP w/Luer Test Adapter (P/N 4116111-001)
-- Pressure Monitor Test Adapter (P/N 4115043 or equivalent)

Key test equipment and materials illustrations are shown on following pages.

4114807 PRESSURE TEST ASSEMBLY , WITH ADAPTERS





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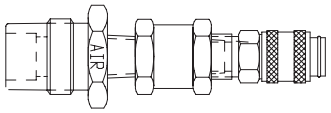
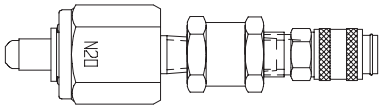


4114830-001



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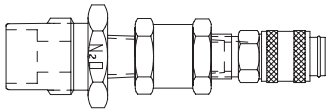

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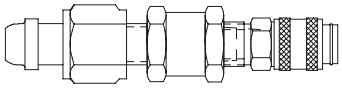

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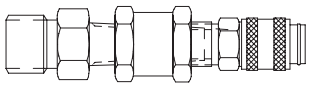
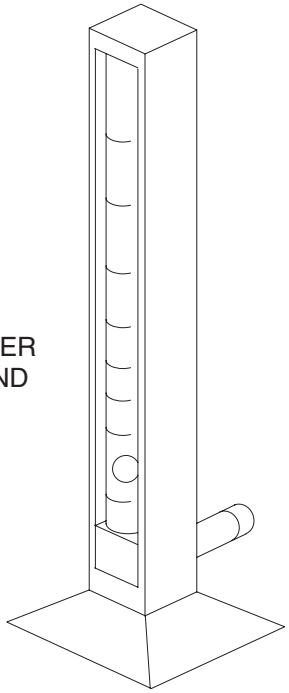
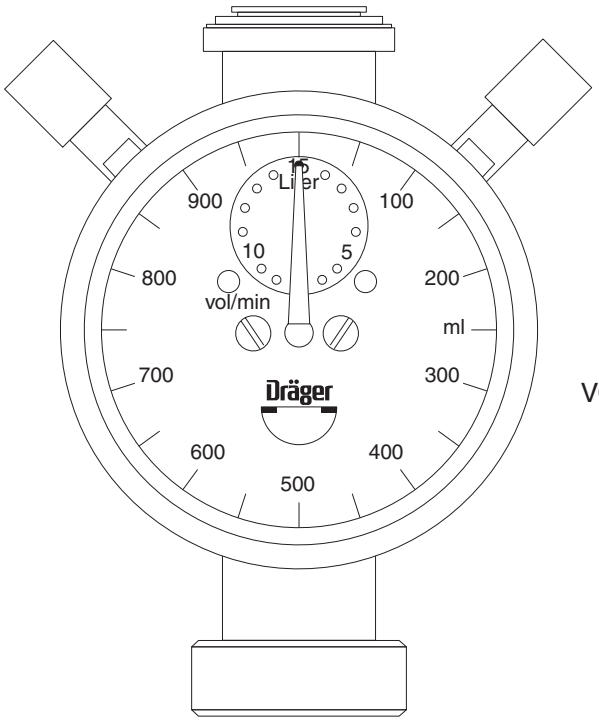


4114830-005

SP15001

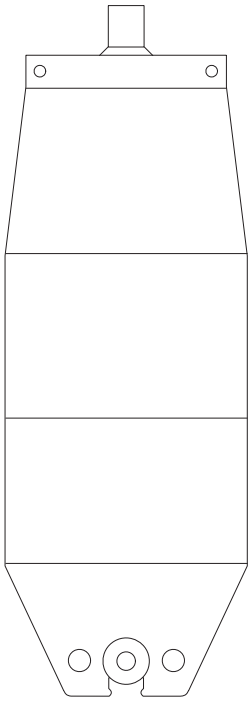
S000081
FLOW METER
TEST STAND



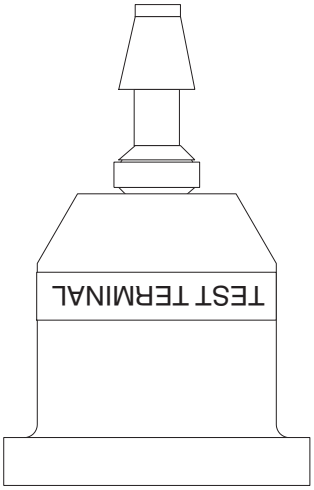


2212300
MINUTE
VOLUMETER

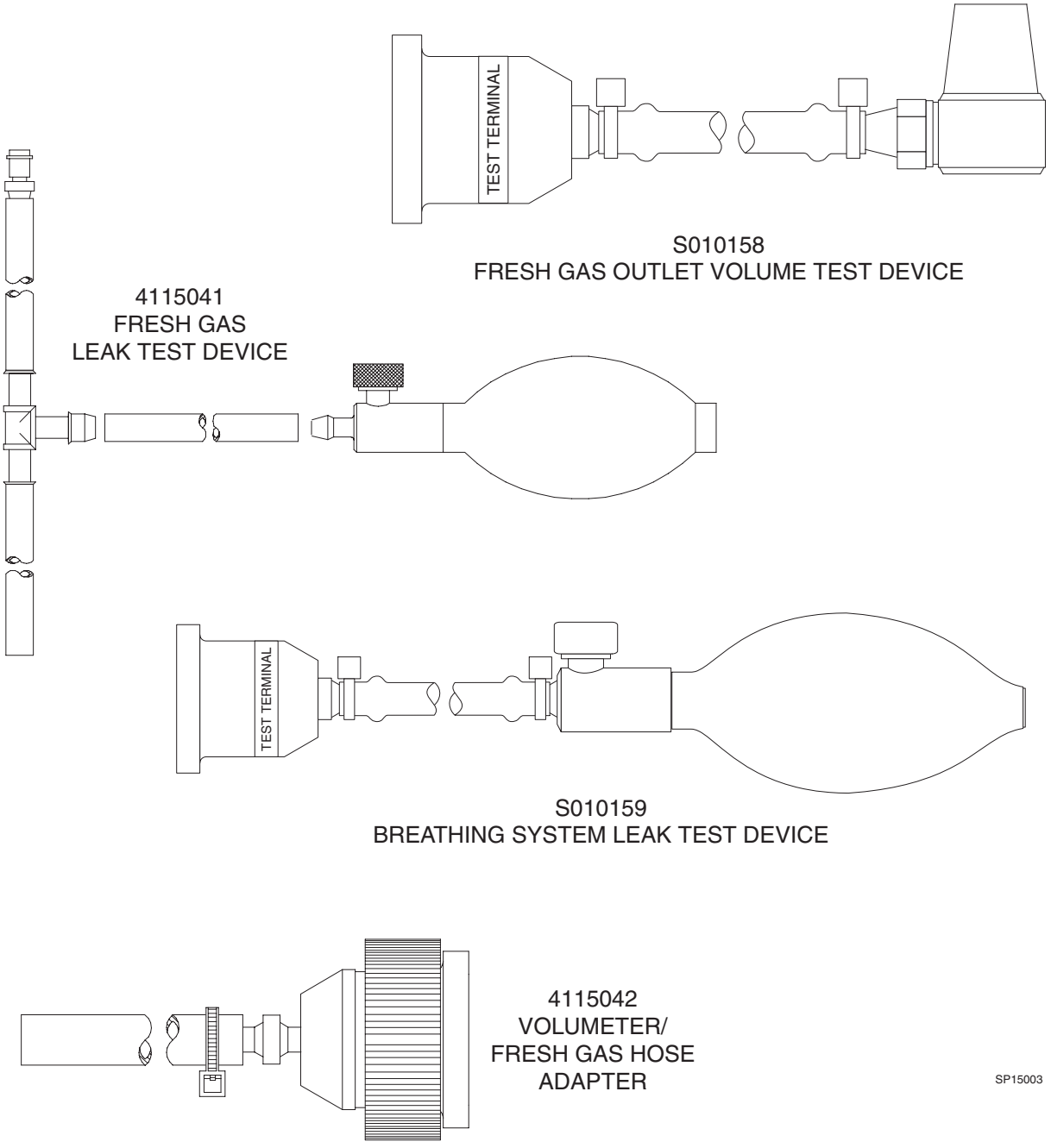
8401892
SIEMENS TEST LUNG

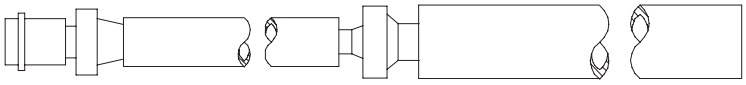


4104389
TEST TERMINAL
ADAPTER

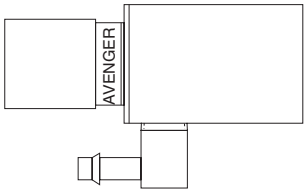


SP15002

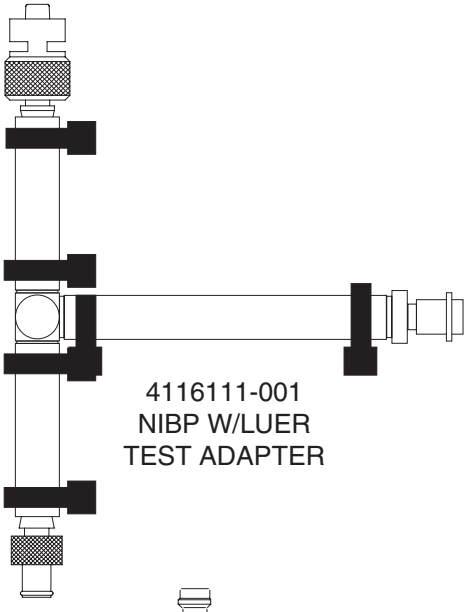

TEST TERMINAL
S010158
FRESH GAS OUTLET VOLUME TEST DEVICE
4115041
FRESH GAS
LEAK TEST DEVICE
TEST TERMINAL
S010159
BREATHING SYSTEM LEAK TEST DEVICE
4115042
VOLUMETER/
FRESH GAS HOSE
ADAPTER
SP15003



4115038
PDM TO PATIENT SUCTION ADAPTER



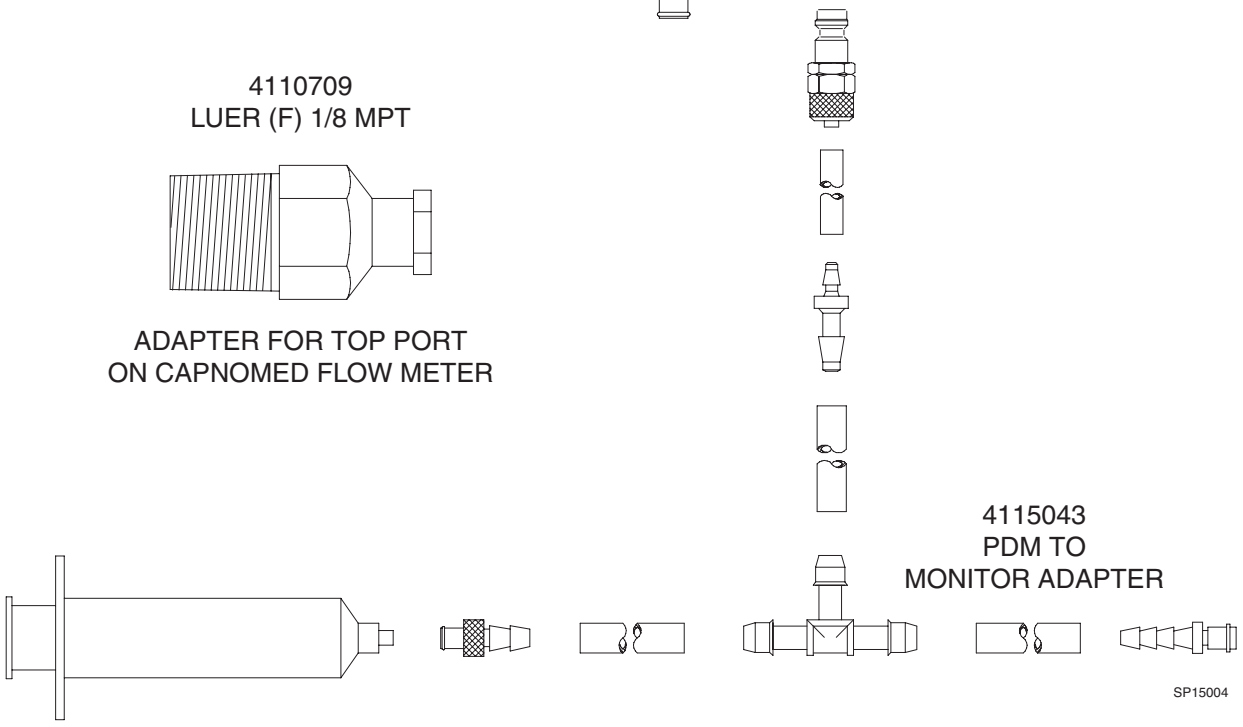
4108114
SCAVENGER ADAPTER



4116111-001
NIBP W/LUER
TEST ADAPTER

4110709
LUER (F) 1/8 MPT

ADAPTER FOR TOP PORT
ON CAPNOMED FLOW METER



4115043
PDM TO
MONITOR ADAPTER

SP15004

Periodic Manufacturer's Certification General Instructions

The purpose of this manual is to provide detailed instructions for performing a Periodic Manufacturer's Certification (PMC) inspection on a Narkomed GS Anesthesia machine.

A PMC consists of a complete Periodic Manufacturer's Service procedure and a certification level inspection based on Draeger Medical, Inc. Recommendations and equipment performance. Additional inspections are also performed to insure proper product labeling.

Several additional documents have been created to ensure the success of this new program. Following is a brief description of the purpose of each document.

Field Service Procedure:

Periodic Manufacturer's Certification Forms - Part Number SP00175. This procedure illustrates sample checklists with typical periodic maintenance items filled in, including vapor concentrations verification tests, parts replaced, general comments and certification levels. Also included are sample PMC labels marked to show several levels of certifications. An excerpt from DMI's ***Anesthesia System Risk Analysis and Risk Reduction*** is included, and also a sample of an Executive Summary to be furnished to the hospital's Risk Manager or Chief of Anesthesia.

Field Service Procedure:

DMI Recommendations Guidelines Index Anesthesia Systems - Part Number S010250. This Guideline was created to provide an assessment of each machine's certification. It contains various comprehensive overviews of possible equipment conditions and their associated certification levels.

The first list in the Recommendation Guidelines is a reference chart for machine certification based on equipment status. The second is an abbreviated summary of all DMI Recommendations and Failure Codes including the Condition Number, Equipment Condition, Recommended Corrections, Certification Code, and Tests Affected when applicable.

There is also a matrix classified as "Failure Codes" which identifies the correct manner in which to document equipment tests that fail, or were unable to be performed due to circumstances beyond the control of the service technician performing the inspection. (Ex: Air cylinder supply is unavailable to perform Air High Pressure Leak test.) The Failure Codes section also indicates suggested resolution of the situation. Failure Code numbers begin at 34 and use the same certification levels strategy, and carry the same weight as DMI Recommendation equipment condition codes.

The final matrix is the most comprehensive index sorted by machine model and includes Equipment Condition, Certification Code, and DMI Recommendations. It also specifies any suggested upgrade path including ordering information that should be taken such as installing a Bellows with Pressure Limit Control 4109664-S01 Kit, after market modification kit to a machine not equipped with pressure limit control.

The letters A, B, C, D and the Roman Numerals I, II are used as codes in the individual matrix for each model of anesthesia machine. The letters A, B, C, and D are used in descending order to indicate the certification level of the equipment. They are as follows:

A = Certified

B = Certified with Recommendations

C = Conditionally Certified

D = No Certification

Roman Numerals I and II do not affect the certification level but rather are provided to give further instructions to the end user as follows:

I = The system in its present configuration shall only be used with a CO2 monitor incorporating an apnea warning. The operator of the system is advised to frequently scan the CO2 readings and alarm thresholds.

II =The present configuration of equipment requires that the unit operate at all times with an oxygen analyzer that includes a low oxygen warning. The operator of the system is advised to frequently scan the oxygen readings and alarm limits.

Following is an explanation of machine certification levels:

Certified- No DMI Recommendations or Failure Codes apply to machine being inspected. (Only item number 33 - "No Recommendations" shall apply for this certification level.)

Certified with Recommendations- A numbered DMI Recommendation or Failure Code with a code of B applies to the machine being examined.

Conditionally Certified- A numbered DMI Recommendation or Failure Code with a code of BCI or BCII applies to the machine being examined.

No Certification- A numbered DMI Recommendation or Failure Code with a code of D applies to the machine being examined.

When multiple recommendations apply, "No Certification" would take precedence over "Conditionally Certified" and "Certified with Recommendations". "Conditionally Certified" would take precedence over "Certified with Recommendations".

For example:

A **Narkomed 2B** could have DMI Recommendation number 21 and Failure Code 61.1 that apply. 21 - No ventilator pressure limit control. Code is B. 61.1 - Enflurane agent is unavailable to test. Code is BC. Correct certification for this machine is BC, which means CONDITIONALLY CERTIFIED WITH RECOMMENDATIONS.

A **Narkomed 4** could have DMI Recommendation numbers 14 and 21 apply.
14 - CO2/Agent monitor exhaust port is not properly connected to the waste gas scavenger. Code B. 21 - No ventilator pressure limit control. Code B.
The correct certification for this machine is B, which means "CERTIFIED WITH RECOMMENDATIONS".

A **Narkomed 2B, 2C or GS** could have DMI Recommendation 30 apply. 30 - Anesthesia machine is equipped with inhalation anesthesia vaporizers without an agent analyzer in the breathing system. Code B.
The correct certification for this machine is B, which means "CERTIFIED WITH RECOMMENDATIONS".

A **Narkomed 6000** could have no DMI Recommendations or Failure Codes apply. The correct certification level for this machine is Code A, "CERTIFIED". The correct certification for this machine is A, which means "CERTIFIED".

Code, D also means "NO CERTIFICATION", also means the machine shall not receive a Periodic Manufacturer's Certification label. The machine shall receive a "WARNING - This System Is Not Certified" label, P/N 4114857. This label shall be placed at a prominent location on the right side of the machine after all other previous PM and "Vigilance Audit(r) Validation" labels have been removed.

PM Certification Procedure for Narkomed GS Anesthesia System

1. Use the PM Certification form for Narkomed 2B/ 2C/ GS Anesthesia Systems (P/N S010211).
2. Completely fill in the header information.
1. All Narkomed GS are equipped with Humphrey valves and do not require lubrication. Indicate so with a (H) next to the “Vent Valve Lube Due” line on the Periodic Manufacturer’s Certification form.
2. Replace the VENTILATOR RELIEF VALVE DIAPHRAGM every 12 months in accordance with SP00075. Place a check mark and indicate the next replacement date at “Relief Valve Diaphragm Due” line on the Periodic Manufacturer’s Certification form.
5. If machine is equipped with a HALOTHANE Dräger Vapor 19 or 19.1 vaporizer, determine if vaporizer must be inspected for soil condition one. Check the serial number plate located on the rear of the vaporizer for a plus (+) preceding the serial number. A HALOTHANE vaporizer serial number not preceded with a (+) must be tested for soil in accordance with SP00073. If vaporizer does not need to be inspected, indicate so with a plus (+) next to the “Vapor Inspection (H)” line on the Vigilance Audit form. If vaporizer is soil condition 0, indicate so with “SOIL 0” written next to the “Vapor Inspection (H)” line on the Vigilance Audit form. If vaporizer is soil condition one, indicate so with “SOIL 1” written next to the “Vapor Inspection (H)” line on the Vigilance Audit form. Place a “CAUTION DO NOT USE” label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the equipment operator to remove the failed vaporizer from the machine and apply a replacement vaporizer or an adapter block onto the mount. All “SOIL 1” vaporizers must be removed from service for machine to receive certification.
6. Perform the vapor concentration test on all Dräger vapor vaporizers in accordance with SP00073 at a six month maximum interval. Perform the vaporizer concentration test on all Desflurane vaporizers in accordance with SP00091 for fixed mount vaporizers and SP00189 for user removable D-tec vaporizers at a six month maximum interval. For every vaporizer tested, fill out a “VAPOR VAPORIZER CALIBRATION CHECK” label (part # S010016). Information on this label shall include your signature, type of agent, date tested, a No Agent To Test or the test results @ 1%, 2.5%, 4% for H, E, I, or S vaporizers, or @ 4%, 10%, 12%, 16% for Desflurane vaporizers, and a PASS or FAIL indication. This label shall be attached to the upper right side of the vaporizer. If vaporizer fails the concentration verification, internal leak, or exclusion system tests, check “NO” in the “RECOMMENDED FOR USE” section on the PM Certification form. Place a “CAUTION DO NOT USE” label (part # 4114327) on the vaporizer, and issue a departmental alert. The TSR shall also seek permission from the customer to remove the failed vaporizer from the machine and install a replacement vaporizer or an adapter block onto the mount. All nonfunctional vaporizers must be removed from service for machine to receive certification.

7. Proceed with PM Certification procedure. If any tests fail refer to the “Failure Codes” listing in DMI Recommendations Guidelines Index (P/N S010250) to determine correct certification level starting point. Failure codes shall be documented on the “RECOMMENDATIONS / GENERAL COMMENTS” section of the PM Certification form and on the Executive Summary. If a test fails that has not been identified by the “Failure Codes” list, consult with Draeger Medical, Inc. to assess the proper certification level.

8. Based on the “EQUIPMENT CONDITION” inspect the machine for any “DMI RECOMMENDATIONS” that would apply. Use the Narkomed GS section of the “RECOMMENDATION GUIDELINES INDEX” (P/N S010250). Note all applicable DMI recommendations on the Executive Summary.

NOTE: If using a carbon form, indicate the Equipment Condition number and to see reverse side under the “RECOMMENDATIONS / GENERAL COMMENTS” section of the form.

9. Determine the correct certification level of the machine based on the combined lowest common denominator of “Equipment Conditions” and “Failure Codes”. If the machine is at least conditionally certified fill out the “PM CERTIFICATION” label. Check the box(s) on the validation label where appropriate. Write the month and year, (three months from date of PM Certification) next to “NEXT VISIT DUE:”. If certification level is “D”, machine shall not receive a “PM CERTIFICATION” label. Any machine not receiving a PM Certification label shall receive a “WARNING NOT CERTIFIED” label, P/N **4114857**. This label shall be placed at a prominent location on the left side of the machine after all other previous PMC and Vigilance Audit Validation labels have been removed.

10. In the “CERTIFICATION LEVEL” section of the PM Certification form, record the last visit certification level, the current certification level and the next visit due month and year, (three months from date of PM Certification) in the spaces provided.

11. If applicable, remove the previous PM CERTIFICATION VALIDATION label and attach the new label (P/N S010006 w/phone #, or S010007 w/o phone #) in a prominent location on the rear of the anesthesia machine.

12. Check the appropriate boxes on the “PM CERTIFICATION NOTICE” label, (part # S010011). If the machine is not certified, the last box of this notice label shall be marked. Attach this notice near the flowmeter shield of the anesthesia machine.

13. Have the customer sign each PM Certification form or the Executive Summary, and review any Failure Codes equipment conditions and DMI Recommendations with the customer.

14. Return top copy to Draeger Medical, Inc. Service Department, keep middle copy for service organization records, give bottom copy to customer.

(✓) 6.1 SELF-DIAGNOSTICS

6.1.1 Turn the System Power switch to ON and verify the "ON" LED is lighted?

6.1.2 Verify all LED's on the keypad and ventilator displays are lit if applicable.

6.1.3 Verify that the following is displayed on the alarm CRT:

NARKOMED GS
COPYRIGHT 1996, NAD, INC.
VERSION X.XX NMGS POD
SOFTWARE ID. XXXX

FIRMWARE		**PASS**
RAM		**PASS**
VIDEO		**PASS**
A/D CONVERTER		**PASS**
AUDIO	**- PRIMARY**	**PASS**
	- BACKUP	**PASS**
SERIAL I/O		**PASS**
CLOCK		**PASS**
NON-VOLATILE MEMORY		**PASS**

FUNCTIONAL

(✓) 6.1.4 Record the machine software version on the header of the checklist form.

(✓) 6.2 ELECTRICAL SAFETY- One Year Service Interval; Due Date _____

(✓) 6.2.1 Ground Continuity

6.2.1.1 Unplug the AC power cord for all devices mounted to the machine that may provide an alternate path to earth ground, such as a Desflurane vaporizer.

6.2.1.2 Unplug the machine's AC power cord and plug the power cord of the safety analyzer into this AC receptacle.

NOTE: Do not plug the safety analyzer power cord into a line isolation monitor circuit, as inaccurate readings may occur.

NOTE: The BIOTECH 501 PRO will automatically test the source outlet for open ground (or ground resistance of 31 Ohms or higher), reverse polarity, open neutral and open line. (The latter two conditions will prevent the analyzer from powering up.)

6.2.1.3 Turn on the safety analyzer and set it's function switch to the GROUND WIRE RESISTANCE position. Attach the test lead to the red SINGLE LEAD connector of the analyzer. Connect the other end of the red test lead to the AC receptacle ground socket on the safety analyzer. Verify a displayed resistance of 0.00 ohms or, if necessary, press the CALIBRATE key on the front panel of the analyzer to zero the device.

6.2.1.4 Set the safety analyzer GROUND switch to NORMAL. Set the POLARITY switch to OFF.

6.2.1.5 Plug the machine's AC power cord into the safety analyzer.

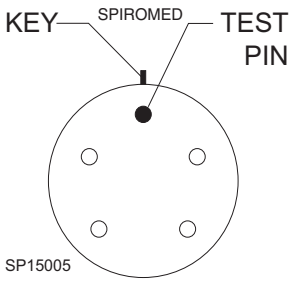
6.2.1.6 Apply the analyzer's test lead to a cylinder yoke bolt.

6.2.1.7 What is the value displayed on the safety analyzer? ___ ohm (0-0.1)

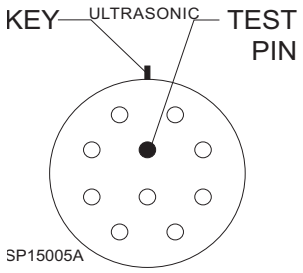
(✓) 6.2.2 Circuit Isolation

6.2.2.1 Disconnect the respiratory volume sensor cord from the interface panel.

6.2.2.2 Using a multimeter set to its highest resistance range apply the test leads between the yoke bolt and circuit common at the volume interface test pin. Refer to the corresponding illustrations for the proper test pin location. There shall be no continuity between these points.



6.2.2.3 Reconnect the respiratory volume sensor cord to the interface panel.



6.2.3 Chassis Leakage Current

6.2.3.1 Apply the analyzer test lead to a cylinder yoke bolt.

6.2.3.2 Set the safety analyzer to the CHASSIS LEAKAGE CURRENT position.

(✓) 6.2.3.3 Record the total leakage current with the Polarity and Ground switches set as follows:

Ground	Polarity
Normal	Normal
Open	Normal
Open	Reversed
Normal	Reversed

6.2.3.4 Verify that the leakage current is 100* microamps or less in each of the switch positions (110 microamps or less for the 220/240 volt power supply option).

6.2.3.5 300 microamps if external monitors are plugged into convenience receptacles.

6.2.3.6 Shut off and unplug the safety analyzer. Remove the anesthesia machine plug from the analyzer and plug it back into the original AC receptacle.

(✓) 6.2.4 Convenience Receptacle and Auxiliary Outlet Strip

NOTE: This test will check the convenience receptacle and the auxiliary strip outlets for fault conditions such as open ground, reverse polarity, open line and open neutral.

6.2.4.1 Unplug all power cords from the convenience receptacles and auxiliary outlet strip.

6.2.4.2 Plug the Receptacle Tester into the first outlet to be tested. Verify no wiring fault is indicated then remove test plug and move it to the next convenience outlet. Repeat this process until all convenience outlets and auxiliary strip outlets are tested.

6.2.4.3 Plug-in all power cords previously removed from the convenience receptacles and auxiliary outlet strip.

(✓) 6.3 CONFIGURATION

6.3.1 Press the CONFIG key.

6.3.2 The CONFIGURE screen is displayed.

6.3.3 Verify the correct Time and Date.

6.3.4 Press the exit key to exit the function.

6.4 SERVICE DATA

6.4.1 Press and hold the Oxygen High Limit key and the Volume Low Limit key, and then press the arrow up key.

6.4.2 The Main Service Screen shall appear.

6.4.3 Select and enter the Service Log.

6.4.4 Verify any pertinent information from the Service Log. Contact the Draeger Medical, Inc. Technical Service Department if necessary.

6.4.5 Press EXIT to return to the Main Service screen.

6.4.6 Select the SRVC Service Code.

6.4.7 Select and enter your Technical Service Rep. I.D. number.

(✓) 6.4.8 Press the RESET key. This resets the last service date to the current date and resets the hours run since last service to zero.

6.4.9 Press the PMS SCHED key.

(✓) 6.4.10 Select and enter the month of the next service due date and record this information on the report. The internal clock of the machine limits the amount of date advance to a maximum of six months from the current service date.

6.4.11 Press the exit key to return the main service screen, If not performing monitor calibrations press the exit key again to return to normal operation mode.

(✓) 6.5 CALIBRATIONS - One Year Service Interval; Due Date _____

6.5.1 To bring up the Oxygen Monitor Service Screen, press the Mon Cal key.

6.5.2 Remove the Oxygen sensor from the valve dome adapter, and remove the Oxygen sensor capsule from the Oxygen sensor housing.

(✓) 6.5.3 When the CURRENT CELL A and CURRENT CELL B readings have stabilized, press the ZERO key and verify that the new offset values are stored.

NOTE: The higher the offset, the higher the calculated O2 concentration appears at high concentrations.

6.5.4 Put the Oxygen sensor capsule into the Oxygen sensor housing.

6.5.5 Press the PRESS MON key.

6.5.6 Disconnect the Pressure monitor's sensor line from the absorber and expose it to ambient air.

6.5.7 Let the Current Pressure Value stabilize and press the ZERO key to store the value.

6.5.8 Connect a Pressure monitor adapter, (P/N 4115043) and calibrated digital pressure manometer to the breathing pressure sensor line.

6.5.9 Pressurize the circuit to 50 cm H_2O and allow the Current Value to stabilize.

(✓) 6.5.10 Press the SPAN key and verify that the new span values are stored.

6.5.11 Release the pressure, disconnect the manometer and test fixture, and reconnect the breathing pressure sensor line to the absorber.

6.5.12 Press EXIT to return to the Main Service screen.

6.5.13 Press EXIT to return to normal operation.

(✓) 6.6 ABSORBER MAINTENANCE

6.6.1 Remove the O_2 sensor or the plug from the inspiratory valve dome adapter and examine the O-rings on each assembly. Replace O-rings as necessary.

6.6.2 Remove the inspiratory and the expiratory valve domes.

6.6.3 Are all pins on the valve crater undamaged? Inspiratory ___ (Y) Expiratory ___ (Y)

6.6.4 Are all pins on the valve domes undamaged? Inspiratory ___ (Y) Expiratory ___ (Y)

6.6.5 Is the valve disc in good condition? Inspiratory ___ (Y) Expiratory ___ (Y)

6.6.6 Are the valve dome washers in good condition? ___ (Y)

6.6.7 Reinstall the inspiratory and expiratory valve domes.

6.6.8 Ultrasonic Flow Sensor - If applicable

6.6.8.1 Remove the Ultrasonic Flow Sensor connector hose.

6.6.8.2 Is the connector hose, connector, and O-ring in good condition? ___ (Y)

6.6.8.3 Remove the expiratory valve.

6.6.8.4 Is the washer under the valve in good condition? ___ (Y)

6.6.8.5 Reattach the expiratory valve.

6.6.8.6 Remove the ultrasonic flow sensor from the mounting bracket.

6.6.8.7 Remove the flow housing/transducer assembly from the electronics housing.

6.6.8.8 Remove both transducers from the flow housing; examine each O-ring and condition of all components, then reassemble the ultrasonic flow sensor.

6.6.8.9 Reattach the ultrasonic flow sensor to the mounting bracket.

6.6.8.10 Reattach the connector hose between the sensor and expiratory valve.

6.6.9. Lubrication, Spiromed Sensor - If applicable

6.6.9.1 Remove the expiratory valve.

6.6.9.2 Is the washer under the valve in good condition? ___ (Y)

6.6.9.3 Remove the Spiromed sensor.

6.6.9.4 Is the washer under the sensor in good condition? ___ (Y)

6.6.9.5 Locate the four lateral holes at the sides of the Spiromed sensor marked by arrows.

CAUTION: Use only Sensor Lubrication Kit P/N 2218180 for the following procedure.

6.6.9.6 Dip the tip of the pipette into the lubricant and draw lubricant into the pipette by pulling the pin backwards.

6.6.9.7 Insert the pipette into one of the four holes as far as it will go. Push the pin forward to its stop and inject lubricant into the hole.

6.6.9.8 Repeat the previous 2 steps for the lubricating three remaining holes.

6.6.9.9 Wipe any lubricant residue from the exterior of the sensor.

6.6.9.10 Reattach the sensor to the absorber top dome.

6.6.9.11 Reattach the expiratory valve to spiromed sensor.

6.6.10. Remove the inspiratory valve assembly.

6.6.11. Is the washer under the valve in good condition? ___ (Y)

6.6.12 Reinstall the inspiratory valve.

6.6.13 Are there two (2) spring clips on the absorber rods? ___ (Y)

6.6.14 Inspect the following: canisters, canister gaskets, dust cup and O-ring, and soda lime.

6.6.15 Are the canisters, canister gaskets, dust cup and O-ring, and soda lime in good condition? ___ (Y)

6.6.16 Verify the cm H_2O gauge at zero (0) and readjust if necessary.

NOTE: The small slotted screw is the zero adjust.

6.6.17 Reinstall the O_2 sensor plug into the inspiratory valve dome adapter.

6.6.18 Remove the 15-mm connector from the FRESHGAS OUTLET.

6.6.19 Is the Freshgas Outlet assembly in good condition? ___ (Y)

6.6.20 Reconnect the 15-mm connector to the FRESHGAS OUTLET.

(✓) 6.7 HIGH PRESSURE LEAK

NOTE: Minimum cylinder pressures required for High Pressure Leak tests are:
O_2, Air, O_2-HE, N_2, HE: 1000 psi / N_2O, CO_2: 600 psi;

6.7.1 Turn the machine main switch to Standby.

6.7.2 Verify the Auxiliary Oxygen flow control valve is closed.

6.7.3 Disconnect all pipeline supply hoses at the wall outlets.

6.7.4 Open then close and remove each cylinder and if applicable remove the yoke plug from each additional yoke assembly.

6.7.5 Note the reading on each the cylinder pressure gauge and start a stop watch.

6.7.6 Are the two (2) yoke index pins installed securely in each yoke? ___(Y)

6.7.7 Is the proper gas I.D. label affixed to each yoke? ___ (Y)

6.7.8 After two (2) minutes, is the pressure loss for each gas equal or less than 50 psi? ___(Y)

6.7.9 Verify the presence of only one (1) cylinder washer, then reattach and secure the cylinders to each yoke assembly, then open each cylinder valve.

6.8 BREATHING SYSTEM

6.8.1 Breathing System Leak/Exclusion

6.8.1.1 Close all flow control valves.

6.8.1.2 Set the AUTO/MAN selector to BAG.

6.8.1.3 Close the APL valve.

6.8.1.4 Interconnect a 22 mm hose (P/N 9995132) between the inspiratory valve and expiratory valve or expiratory port on the ultrasonic flow sensor, if applicable.

6.8.1.5 Attach a test terminal (P/N 4104389) to the Fresh Gas Leak Test Adapter (P/N 4115041) then attach the test terminal to the bag mount.

6.8.1.6 Apply 50 cm H_2O test pressure to the absorber system and start a stop watch.

6.8.1.7 Is the pressure on the absorber pressure gauge within 47 to 53 cm H_2O? ___(Y)

(✓) 6.8.1.8 After thirty (30) seconds, is the breathing system test pressure equal or greater than 40 cm H_2O? ___ (Y)

6.8.1.9 If applicable, turn on the left mounted vaporizer to the first graduated marking. Reapply 50 cm H_2O of pressure to the system and start a stopwatch. Is it possible to turn on either the center or right vapors? ___ (N)

(✓) 6.8.1.10 After thirty (30) seconds, is the left vaporizer test pressure equal or greater than 40 cm H_2O? ___(Y) Turn off the left vaporizer.

6.8.1.11 If applicable, turn on the center mounted vaporizer to the first graduated marking. Reapply 50 cm H_2O of pressure to the system and start a stopwatch. Is it possible to turn on either the left or right vapors? ___ (N)

(✓) 6.8.1.12 After thirty (30) seconds, is the center vaporizer test pressure equal or greater than 40 cm H_2O? ___(Y) Turn off the center mounted vaporizer.

6.8.1.13 If applicable, turn on the right mounted vaporizer to the first graduated marking. Reapply 50 cm H_2O of pressure to the system and start a stopwatch. Is it possible to turn on either the left or center vapors? ___ (N)

(✓) 6.8.1.14 After thirty (30) seconds, is the right vaporizer test pressure equal or greater than 40 cm H_2O? ___ (Y) Turn off the right mounted vaporizer.

(✓) 6.8.1.15 Did all vaporizer exclusion verifications test positive? ___ (Y)

6.8.2 APL Valve

6.8.2.1 Open the APL valve to its stop.

6.8.2.2 Turn the System Power switch to ON.

6.8.2.3 Set the Oxygen flow to 8 l/min.

(✓) 6.8.2.4 Is the pressure within 0 to 3 cm H_2O? ___ (Y)

6.8.3 O_2 Flush

6.8.3.1 Attach a 33 mm x 22 Female Adapter (P/N 4115087) to the top port of the test volumeter.

6.8.3.2 Disconnect the hose from the expiratory valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable and attach it to the test volumeter adapter.

6.8.3.3 Close the APL valve.

6.8.3.4 Press and hold the O2 FLUSH button for 6 seconds; multiply the value obtained by 10.

(✓) 6.8.3.5 Is the calculated O2 flush flow rate 45 to 65 l/min.? ___ (Y)

6.8.3.6 After releasing the flush, does the flow of Oxygen stop immediately? __ (Y)

6.8.3.7 Remove the test equipment.

6.8.4 Expiratory Valve Leak

6.8.4.1 Connect a 22 mm hose (P/N 9995132) between the inspiration valve and the bag mount.

6.8.4.2 Connect a test terminal (P/N 4104389) to the expiration valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable.

6.8.4.3 Connect a 0-250 ml/min. flowmeter (S000081) to the test terminal.

6.8.4.4 Turn up the Oxygen flow until the system pressurizes to 30 cm H2O. Adjust the APL valve as necessary to maintain 30 cm H2O.

(✓) 6.8.4.5 Is the value indicated on the flowmeter within 0 to 60 ml/min.? ___ (Y)

6.8.4.6 Close APL valve.

6.8.4.7 Remove all test equipment.

6.8.5 Inspiration Valve Leak

6.8.5.1 Turn the System Power switch to Standby.

6.8.5.2 Connect a test terminal (P/N 4104389) to the inspiratory valve.

6.8.5.3 Connect a Fresh Gas Leak Adapter (P/N 4115041) and calibrated pressure meter to the test terminal on the inspiratory valve.

6.8.5.4 Connect another test terminal to the bag connector.

6.8.5.5 Connect a 0-250 ml/min. flowmeter (S000081) to the test terminal on the bag mount.

6.8.5.6 Pressurize the test circuit to 30 cm H2O.

(✓) 6.8.5.7 Is the value indicated on the flowmeter within 0 to 60 ml/min.? ___ (Y)

6.8.5.8 Turn the system power switch to ON.

6.8.5.9 Remove all test equipment.

6.8.6 PEEP Valve w/Bypass - If applicable

6.8.6.1 Open the APL valve.

6.8.6.2 Interconnect the inspiratory valve and expiratory valve or expiratory port on the ultrasonic flow sensor, if applicable with a 22 mm hose (P/N 9995132).

6.8.6.3 Attach a Breathing System Leak Test Adapter (P/N S010159) to the bag mount.

6.8.6.4 Disconnect the pressure pilot line from the absorber and replace it with a PDM To Monitor Adapter (P/N 4115041).

6.8.6.5 Connect a test gauge to the adapter.

6.8.6.6 Set the O_2 flow to 5 l/min.

6.8.6.7 * Place the PEEP bypass in the ON position.

6.8.6.8 Adjust the absorber PEEP valve clockwise to the maximum position.

6.8.6.9 Does the PEEP valve adjust smoothly? ___ (Y)

(✓) 6.8.6.10 Is the maximum PEEP indicated on the test gauge within 15 to 22 cm H_2O? ___ (Y)

6.8.6.11 * Place the PEEP bypass in the OFF position.

6.8.6.12 * Does the PEEP return to ≤ 3 cm H_2O? ___(Y)

6.8.6.13 Adjust the absorber PEEP valve counterclockwise to its minimum position.

6.8.6.14 Does the PEEP return to ≤ 3 cm H_2O? ___(Y)

6.8.6.15 Close the O_2 flow control valve.

6.8.6.16 Remove the test equipment and reconnect the pilot line to the absorber.

* These items apply only to machines with a PEEP by-pass.

6.8.7 Bain Circuit Adapter - If applicable

6.8.7.1 Close the Bain Circuit APL valve by turning the knob fully clockwise.

6.8.7.2 Verify the cm H_2O gauge at zero (0) and readjust if necessary.

NOTE: The small slotted screw is the zero adjust.

6.8.7.3 Insert the O_2 sensor plug into the O_2 sensor inlet on the Bain Circuit.

6.8.7.4 Attach a Breathing System Leak Device (P/N S010159) to the Breathing Bag port on the Bain Circuit.

6.8.7.5 Disconnect the pressure pilot line from the Bain Circuit and replace it with a PDM To Monitor Adapter (P/N 4115041).

6.8.7.6 Connect a test gauge to the adapter.

6.8.7.7 Occlude the expiration port on the Bain Circuit.

6.8.7.8 Apply 50cm H_2O test pressure to the Bain Circuit.

6.8.7.9 Is the pressure indicated on the cm H_2O gauge within 3 cm H_2O of the digital pressure meter reading? ___ (Y)

(✓) 6.8.7.10 After 30 seconds, is the test pressure 45 to 50 cm H_2O? ___ (Y)

6.8.7.11 Open the APL valve by turning the knob fully counter-clockwise.

6.8.7.12 Connect a Fresh Gas Outlet Volume Adapter (P/N S010158) between the fresh gas outlet and the Expiration port of the Bain Circuit.

6.8.7.13 Set the O_2 flow to 8 l/min.

(✓) 6.8.7.14 Is the test pressure within 0 to 3 cm H_2O? ___ (Y)

6.8.7.15 Remove the test equipment and reconnect the pilot line to the Bain Circuit.

6.9 OXYGEN ANALYZER

6.9.1 Press the CAL key.

NOTE: Make sure that the sensor has stabilized in ambient air for several minutes.

(✓) 6.9.2 After calibration is completed, is the O_2 concentration 21 %? ___(Y)

6.9.3 The warning message INSP O_2 LOW shall appear on the central alarm display, and a continuous alarm shall sound.

6.9.4 Press the Alarm Silence key and verify the audio alarm is silenced.

6.9.5 Place the Oxygen sensor into the inspiratory valve dome adapter.

6.9.6 Set the AUTO/MAN selector to BAG.

6.9.7 Close the APL valve.

6.9.8 Attach a 22 mm hose (P/N 9995132) to the inspiratory valve.

6.9.9 Attach a Breathing System Leak Test Device (P/N S010159) to the bag mount.

6.9.10 Press the O_2 Flush.

6.9.11 After 10 seconds, is the O_2 concentration 90 to 100 % O_2? ___ (Y)

6.9.12 Release the O_2 Flush, does the flow cease immediately? ___ (Y)

6.9.13 Set the Oxygen flow to 10 l/min.

(✓) 6.9.14 After 1 minute, is the O_2 concentration 97 to 100%? ___ (Y)

6.10 FLOWMETERS CONCENTRATIONS

(✓) 6.10.1 Oxygen Flowmeter

6.10.1.1 Is it possible to adjust the flow of Oxygen over the full range of the flowmeters? ___ (Y)

6.10.1.2 Set the Oxygen flow to 4 l/min.

6.10.1.3 Is the correct flow control knob and label attached to the Oxygen flow control valve? ___ (Y)

(✓) 6.10.2 Oxygen-Helium Flowmeter - If applicable

6.10.2.1 Is it possible to adjust the flow of the Oxygen-Helium over the full range of the flowmeter? ___ (Y)

6.10.2.2 Set the Oxygen-Helium flow to 2 l/min.

6.10.2.3 *After the value stabilizes, is the O_2 concentration 72 to 78%? ___ (Y)

6.10.2.4 Close the Oxygen-Helium flow valve.

6.10.2.5 Is the correct flow control knob and label attached to the Oxygen-Helium flow control valve? ___ (Y)

*Oxygen-Helium specifications are given @ 25% O_2. Cylinder content deviations will affect this value. The expected concentration values can be obtained by replacing the '25' % O_2 value given for O_2-HE with the actual cylinder content as follows:

$$\frac{(2 \text{ l/min } O_2\text{-HE} \times \text{'25'}) + (4 \text{ l/min. } O_2 \times 100)}{6 \text{ l/min - Total Flow}} = \%\ O_2$$

6.10.3 This Section Intentionally Left Blank

6.10.4 This Section Intentionally Left Blank

(✓) 6.10.5 Carbon Dioxide Flowmeter - If applicable

6.10.5.1 Is it possible to adjust the flow of the Carbon Dioxide over its range of 550 ml/min.? ___ (Y)

6.10.5.2 Set the Oxygen flow to 1000 ml/min.

6.10.5.3 Set the Carbon Dioxide flow to 500 ml/min.

6.10.5.4 After the value stabilizes, is the O_2 concentration 64 to 70%? ___ (Y)

6.10.5.5 Close the Carbon Dioxide flow valve.

6.10.5.6 Readjust the Oxygen flow to 4 l/min.

6.10.5.7 Is the correct flow control knob and label attached to the Carbon Dioxide flow control valve? ___ (Y)

(✓) 6.10.6 Air Flowmeter - If applicable

6.10.6.1 If not configured with an Air Cylinder yoke, attach the Air Pipeline hose.

6.10.6.2 Is it possible to adjust the flow of the Air over the full range of the flowmeter? ___ (Y)

6.10.6.3 Set the Air flow to 2 l/min.

6.10.6.4 After the value stabilizes, is the O_2 concentration 71 to 77%? ___ (Y)

6.10.6.5 Close the Air flow control valve.

6.10.6.6 Is the correct flow control knob and label attached to the Air flow control valve? ___ (Y)

(✓) 6.10.7 Nitrous Oxide Flowmeter

6.10.7.1 Set the Nitrous Oxide flow to 2 l/min.

6.10.7.2 After the value stabilizes, is the O_2 concentration 64 to 70% ___ (Y)

6.10.7.3 Is the correct flow control knob and label attached to the Nitrous Oxide flow control valve? ___ (Y)

6.10.7.4 Is it possible to adjust the flow of Nitrous Oxide over the full range of the flowmeter? ___ (Y)

6.10.8 Oxygen Ratio Control

6.10.8.1 Open the Nitrous Oxide flow control valve to the stop position.

(✓) 6.10.8.2 After the value stabilizes, is the O_2 concentration 21 to 29%? ___(Y)

6.10.8.3 Set the Oxygen flow to 2 l/min.

(✓) 6.10.8.4 After the value stabilizes, is the O_2 concentration 21 to 29%? ___ (Y)

6.10.8.5 Set the Oxygen flow to 1000 ml/min.

(✓) 6.10.8.6 After the value stabilizes, is the O_2 concentration 21 to 29%? ___ (Y)

6.10.8.7 Reduce the O_2 flow to 500 ml/min. Verify that the N_2O flow is greater than or equal to 600 ml/min.

6.10.8.8 Close the Oxygen flow control valve.

6.10.8.9 Close the Nitrous Oxide flow control valve.

6.10.9 This Section Intentionally Left Blank

(✓) 6.10.10 Auxiliary Oxygen Flowmeter - If applicable

6.10.10.1 Connect a test pressure monitor to the Auxiliary Oxygen outlet using a PDM/Suction adapter (P/N 4115038).

6.10.10.2 Increase the pressure to 50 cm H_2O.

6.10.10.3 After 10 seconds, is the pressure within 40 to 60 cm H_2O? ___ (Y)

6.10.10.4 Remove the test gauge and adapter.

6.10.10.5 Is it possible to adjust the Auxiliary Oxygen flowmeter over the full range of the flowmeter? ___(Y)

6.10.10.6 Set the flow rate to 5 l/min.

6.10.10.7 Hold the Oxygen sensor at the flowmeter outlet.

6.10.10.8 After the value stabilizes, is the O_2 concentration within 80 to 100% ___ (Y)

6.10.10.9 Replace the Oxygen sensor into the Inspiratory valve dome.

6.10.10.10 Close the Auxiliary Oxygen flow control valve.

(✓) 6.11 HIGH PRESSURE REGULATOR - Six Month Service Interval; Due Date _____

6.11.1 N_2O Regulator

NOTE: Minimum cylinder pressure for N_2O regulator test is 600 psi.

6.11.1.1 Configure the test gauge (P/N 4114807) using a N_2O nut/stem DISS connector (P/N 4114830-004) on the hose, and N_2O DISS body connector (P/N 4114830-003) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.

6.11.1.2 Connect the test fixture hose to the machine's Nitrous Oxide pipeline inlet.

6.11.1.3 Connect the Nitrous Oxide pipeline supply hose to the test fixture.

6.11.1.4 Open the Nitrous Oxide and the Oxygen cylinder valves.

6.11.1.5 Set the Oxygen and Nitrous Oxide flows to 4 l/min.

6.11.1.6 Depress the push button on the test device.

(✓) 6.11.1.7 Release the push button. After the pressure decay stabilizes, is the regulator output pressure 40 to 49 psi? ___(Y)

6.11.1.8 Remove the test fixture.

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

6.11.2 Air Regulator - If applicable

NOTE: Minimum cylinder pressure for Air regulator test is 1000 psi.

6.11.2.1 Configure the test gauge (P/N 4114807) using an Air nut/ stem DISS connector (P/N 4114830-002) on the hose and a DISS body connector (P/N 4114830-001) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.

6.11.2.2 Connect the test fixture hose to the machine's air pipeline inlet.

6.11.2.3 Connect the Air pipeline supply hose to the test fixture.

6.11.2.4 Set the Air flow to 4 l/min.

6.11.2.5 Depress the push button on the test device.

(✓) 6.11.2.6 Release the push button. After the pressure decay stabilizes, is the regulator output pressure within tolerance given in the following table? ___ (Y)

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

Cylinder Pressure psi	USA Compensated Regulator output tolerances	ISO Compensated Regulator output tolerances
2000	38 to 44	41 to 47
1800	39 to 45	42 to 48
1600	40 to 46	43 to 49
1400	41 to 47	44 to 50
1200	42 to 48	45 to 51
1000	43 to 49	46 to 52

6.11.2.7 Remove the test fixture.

6.11.3 O_2 Regulator

NOTE: Minimum cylinder pressure for O_2 regulator test is 1000 psi.

6.11.3.1 Configure a test gauge (P/N 4114807) using an O_2 nut/stem DISS connector (P/N 4114830-006) on the hose and an O_2 DISS body connector (P/N 4114830-005) on the valve body side. If the machine is configured with CSA style fittings reverse the position of the connectors.

6.11.3.2 Connect the test fixture hose to the machine's Oxygen pipeline inlet.

6.11.3.3 Connect the Oxygen pipeline supply hose to the test fixture.

6.11.3.4 Set the Oxygen flow to 4 l/min.

6.11.3.5 Depress the push button on the test device.

(✓) 6.11.3.6 Release the push button. After the pressure decay stabilizes, is the regulator output pressure within the tolerance given in the following table? ___ (Y)

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

Cylinder Pressure psi	USA Compensated Regulator output tolerances	ISO Compensated Regulator output tolerances
2000	38 to 44	41 to 47
1800	39 to 45	42 to 48
1600	40 to 46	43 to 49
1400	41 to 47	44 to 50
1200	42 to 48	45 to 51
1000	43 to 49	46 to 52

(✓) 6.12 LOW O_2 SUPPLY - Six Month Service Interval; Due Date _____

6.12.1 Close the Oxygen cylinder valve and drain all Oxygen pressure.

6.12.2 Depress the push button on the test device.

6.12.3 Adjust the Oxygen flow to 500 ml/min.

6.12.4 Release the test device push button.

6.12.5 Is the pressure on the test gauge when the LO O_2 SUPPLY message appears within 34 to 40 psi? ___ (Y)

6.12.6 Remove the test equipment.

6.13 OXYGEN SUPPLY FAILURE PROTECTION

6.13.1 Connect all pipeline supplies.

6.13.2 Close the Oxygen flow control valve if applicable.

(✓) 6.13.3 *Is the flow of Oxygen 150 to 200ml/min.? ___ (Y)

6.13.4 Open the Nitrous Oxide flow control valve.

(✓) 6.13.5 *Is the flow of Nitrous Oxide 375 to 750 ml/min.? ___ (Y)

6.13.6 Adjust the Oxygen, Nitrous Oxide and additional gas flow to 4 l/min. Set Carbon Dioxide Flow to 500 ml/min., if applicable.

6.13.7 Disconnect the Oxygen pipeline supply and close the Oxygen cylinder valve.

(✓) 6.13.8 Do all fresh gas flows cease when the Oxygen pressure is depleted? ___(Y)

6.13.9 Reconnect the Oxygen pipeline supply.

6.13.10 Close all cylinder valves and then disconnect the Nitrous Oxide pipeline supply, and air pipeline if applicable.

6.13.11 Drain the cylinder contents then reconnect the pipeline supplies.

6.13.12 Close all flow control valves.

* Nitrous Oxide Bypass flow and Minimum Oxygen flow specifications are given @ 50 psi. Pipeline pressure deviations may affect these tests.

6.14 PRESSURE MONITOR

6.14.1 Disconnect the breathing pressure sensor line from the absorber.

6.14.2 Connect a PDM Adapter (P/N 4115043) and test pressure gauge to the breathing pressure sensor line.

6.14.3 Adjust the test pressure to 0 cm H_2O.

6.14.4 Simultaneously set AUTO/BAG valve to AUTO, (Vent ON) and start a stopwatch.

(✓) 6.14.5 Does the APNEA PRESSURE appear on the alarm display as a CAUTION within 13 to 17 seconds? ___ (Y)

(✓) 6.14.6 Increase the test pressure slowly. Does the APNEA PRRESSURE alarm deactivate within 10 to 14 cm H_2O? ___ (Y)

6.14.7 First decrease the pressure then increase the test pressure above the threshold line shown on the display, and begin timing with a stopwatch.

(✓) 6.14.8 Does the CONTINUOUS PRES appear as a warning within 13 to 17 seconds? ___ (Y)

(✓) 6.14.9 Decrease the pressure slowly. Does the CONTINUOUS PRES alarm deactivate within 10 to 14 cm H_2O? ___ (Y)

(✓) 6.14.10 Increase the test pressure slowly. Does a VENT PRESS HI activate as a warning alarm within 47 to 53 cm H_2O? ___ (Y)

(✓) 6.14.11 Create a sub-atmospheric test pressure slowly. Does the SUB ATM PRES warning alarm activate within -7 to -13 cm H_2O? ___ (Y)

6.14.12 Set the AUTO/BAG valve to BAG, (Vent off).

6.14.13 Open APL valve.

6.14.14 Remove the test equipment and reconnect the breathing pressure sensor line to the absorber.

6.15 VENTILATOR

NOTE: Readjustment of inspiratory flow to limit the inspiratory plateau may be required to reduce erratic tidal volumes and breath rates caused by artifact volumes.

6.15.1 Remove the bellows hose and the scavenger hose at the ventilator relief valve. Remove the bellows sub-assembly and remove bellows.

6.15.2 Visually inspect the bellows for deterioration particularly at its seams and corrugations.

6.15.3 Verify the presence of it's sealing O-ring and reassemble the components.

6.15.4 Turn on the ventilator on using the ON/OFF knob.

6.15.5 If applicable, does the FAULT indicator turn on? (Y)

6.15.6 Set the AUTO/MAN selector switch to AUTO.

6.15.7 Does the FAULT indicator turn off? (Y)

6.15.8 Set the FREQUENCY to 10 BPM.

(✓) 6.15.9 Press and hold the EXTENDED RANGE switch and set the I:E ratio to 2:1. Using a stopwatch, time the extended I:E ratio. Is the inspiratory time within 3.6 to 4.4 seconds and the expiratory time between 1.8 to 2.2 seconds? ___ (Y)

(✓) 6.15.10 Set the I:E RATIO to 1:2. Using a stopwatch, time the I:E ratio. Is the inspiratory time between 1.8 to 2.2 seconds and the expiratory time within 3.6 to 4.4 seconds? ___ (Y)

6.15.11 Adjust the Oxygen flow to 500 ml/min.

6.15.12 Set the Tidal Volume to 1200, or if testing an external pediatric bellows set the tidal volume to approximately 300 ml.

6.15.13 Attach a patient circuit to the absorber system.

6.15.14 Set the pressure limit control to MAX.

6.15.15 Adjust the Inspiratory Flow to the bottom of the LOW zone.

6.15.16 Occlude the Y-piece.

6.15.17 Press the O_2 Flush momentarily to inflate the bellows.

6.15.18 Adjust the Inspiratory Flow until a peak pressure of 80 cm H_2O is achieved.

(✓) 6.15.19 If applicable, set the Pressure Limit Control to within the 30 range. Readjust within the band as necessary to achieve proper value. Is the peak pressure at the 30 range within 27 to 33 cm H_2O? ___ (Y)

(✓) 6.15.20 Set the Pressure Limit Control to the MIN position. Is the peak pressure at the MIN range 0 to 15 cm H_2O? ___ (Y) Return the Pressure Limit control to MAX.

6.15.21 Loosen the expiratory valve dome, or if equipped with an ultrasonic flow sensor, open the Y-piece and disconnect the hose attached to the exhalation valve and blow into it.

(✓) 6.15.22 Does the Reverse Flow message appear on the display? ___ (Y)

6.15.23 Tighten the expiratory valve dome if applicable, or if equipped with an ultrasonic flow sensor reconnect the hose between the expiratory valve and the flow sensor.

6.15.24 Insert a test minute volumeter in between absorber dome and Spiromed, or exhalation valve and absorber dome if equipped with an ultrasonic flow sensor.

6.15.25 Open the Y-piece.

6.15.26 Turn the ventilator off and press the ALL STBY key to clear alarms.

6.15.27 Turn the ventilator on and start a stop watch.

(✓) 6.15.28 Does APNEA-VOLUME appear as a Caution within 13 to 17 seconds? ___ (Y)

6.15.29 Attach a 3 liter breathing bag to the Y-piece.

NOTE: Bag should be placed on a flat horizontal surface to reduce artifact volume.

6.15.30 Press the O_2 Flush momentarily to inflate the bellows.

6.15.31 Set the Inspiratory Flow to the MED and readjust as necessary to fully collapse the bellows.

(✓) 6.15.32 Observe the operation of each unidirectional valve disc at eye level. Does the inspiratory valve disc raise only during the inspiration phase, and the expiratory valve raise only during the exhalation phase? ___(Y)

(✓) 6.15.33 Is the tidal volume on the volume monitor and on the test volumeter within 20 % of each other? ___ (Y)

6.15.34 Does the volume monitor display 10 BPM? ___ (Y)

6.15.35 Does the display correctly track the Breathing Pressure waveform? ___ (Y)

6.16 BELLOWS ADULT - If applicable

(✓) 6.16.1 Is the tidal volume indicated on the test volumeter 960 to1440 ml? ___(Y)

(✓) 6.16.2 Does the bellows remain fully inflated during the expiratory pause phase? ___ (Y)

6.16.3 Remove the ventilator hose from the VENTILATOR HOSE terminal.

6.16.4 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.16.5 Connect a 0-250 ml/min. flowmeter (P/N S000081) to the test terminal.

6.16.6 Set the FREQUENCY to 1 BPM.

(✓) 6.16.7 Is the drive gas leakage indicated during the inspiratory phase 0 to 50 ml? ___(Y)

6.16.8 Remove the test equipment from the ventilator hose terminal and reconnect the ventilator hose to the VENTILATOR HOSE terminal.

6.16.9 Set the FREQUENCY to 10 BPM.

6.16.10 Adjust the O_2 flow to 10 l/min.

6.16.11 Adjust the Tidal Volume to maximum.

6.16.12 Press the O_2 Flush momentarily to inflate the bellows.

6.16.13 Adjust the INSPIRATORY FLOW to fully compress the bellows.

(✓) 6.16.14 Is the Tidal Volume on the test volumeter greater than 1400 ml? ___(Y)

(✓) 6.16.15 Is the PEEP value displayed on the monitor 0 to 3 cm H_2O? ___(Y)

6.16.16 Remove the breathing bag from the Y-piece and replace it with a test lung.

6.16.17 Adjust the Oxygen flow to 300 ml/min.

6.16.18 Adjust the Tidal Volume to 200 ml.

6.16.19 Does the bellows stop adjust smoothly and engage properly? ___ (Y)

6.16.20 Adjust the INSPIRATORY FLOW to fully compress the bellows.

(✓) 6.16.21 Is the Tidal Volume on the test volumeter 125 to 250 ml? ___(Y)

6.16.22 Close the Oxygen flow control valve.

6.16.23 Remove the test lung, set the AUTO/BAG selector valve to BAG.

6.16.24 Press the Alarms All Standby key.

6.17 BELLOWS PEDIATRIC EXTERNAL - If applicable

6.17.1 Adjust the fine flow control of the pediatric bellows attachment fully clockwise.

6.17.2 Remove the breathing bag from the Y-piece and replace it with a test lung (P/N 4115128).

6.17.3 Press the O_2 Flush momentarily to inflate the bellows.

(✓) 6.17.4 Does the bellows remain fully inflated during the expiratory pause phase? ___ (Y)

6.17.5 Set the ventilator frequency to 20 BPM.

6.17.6 Adjust the O_2 flow to 3 l/min.

(✓) 6.17.7 Is the tidal volume on the test volumeter greater than 250 ml? ___(Y)

6.17.8 Adjust the tidal volume to the 100 ml mark on the pediatric bellows assembly.

(✓) 6.17.9 Is the tidal volume on the test volumeter within 65 to 135 ml? ___ (Y)

6.17.10 Verify that with the Pediatric Bellows Fine Flow Control turned fully counter-clockwise the bellows does not collapse during inspiration. Readjust the knob to the fully clockwise position.

6.17.11 Adjust the O_2 flow to 10 l/min.

(✓) 6.17.12 Is the PEEP displayed on the monitor 0 to 3 cm H_2O? ___ (Y)

6.17.13 Close the Oxygen flow control valve.

6.17.14 Remove the ventilator hose from the VENTILATOR HOSE terminal.

6.17.15 Attach a test terminal (P/N 4104389) to the bellows assembly ventilator hose terminal.

6.17.16 Connect a 0-250 ml/min. flowmeter (P/N S000081) to the test terminal.

6.17.17 Set the FREQUENCY to 1 BPM.

6.17.18 Set the I:E RATIO to 1:1.

6.17.19 Set the Inspiratory Flow to MAX.

(✓) 6.17.20 Is the drive gas leakage indicated during the inspiratory phase 0 to 50 ml/min? ___ (Y)

6.17.21 Remove the test equipment and reattach the ventilator hose to the VENTILATOR HOSE terminal.

6.17.22 Set AUTO/BAG valve to BAG.

6.17.23 Press the Alarms All Standby key.

6.18 BELLOWS PEDIATRIC INTERNAL - If applicable

6.18.1 Remove the breathing bag from the Y-piece and replace it with a test lung (P/N 4115128).

6.18.2 Press the O_2 Flush momentarily to inflate the bellows.

(✓) 6.18.3 Does the bellows remain fully inflated during the expiratory pause phase? ___ (Y)

6.18.4 Set the ventilator frequency to 20 BPM.

6.18.5 Set the Oxygen flow to 3 liters.

(✓) 6.18.6 Is the tidal volume on the test volumeter greater than 250 ml? ___ (Y)

6.18.7 Adjust the inspiratory flow and Pressure limit control if applicable control until the bellows collapses to the 100 ml mark on the pediatric bellows assembly.

(✓) 6.18.8 Is the tidal volume on the test volumeter 65 to 35 ml? ___ (Y)

6.18.9 Adjust the Oxygen flow to 10 l/min.

(✓) 6.18.10 Is the PEEP displayed on the monitor within 0 to 3 cm H_2O? ___ (Y)

6.18.11 Close the Oxygen flow control valve.

6.18.12 Remove the ventilator hose from the ventilator hose terminal.

6.18.13 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.18.14 Connect a flowmeter test stand (P/N S000081) to the test terminal.

6.18.15 Set the frequency to 1 BPM.

6.18.16 Set the I:E RATIO to 1:1.

(✓) 6.18.17 Is the flow indicated during the inspiratory phase less than 50 ml? ___ (Y)

6.18.18 Remove the test equipment and reattach the ventilator hose to the VENTILATOR HOSE terminal.

6.18.19 Return pressure limit control to MAX.

6.18.20 Set AUTO/BAG valve to BAG.

6.18.21 Press the Alarms All Standby key.

(✓) 6.19 OPEN RESERVOIR SCAVENGER 6-Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.19.1 OPEN RESERVOIR SCAVENGER CLEANING

6.19.1.1 Remove the scavenger hoses and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace as needed.

6.19.1.2 Disconnect the hospital vacuum source from the scavenger.

6.19.1.3 Cleaning procedure for assemblies with 2 large relief ports. If configured with many small vent ports skip to step.

1. Remove the four screws securing the reservoir tube to the main block. Examine the two sealing O-rings and replace as necessary.
2. Remove the screws securing the access panel at the bottom of the scavenger canister.
3. Remove and inspect the silencer; replace if needed.
4. Clean the reservoir tube with compressed air if necessary.
5. Remove the flowmeter from its housing by turning it counterclockwise.
6. Inspect the tube and clean with compressed air if needed.
7. Apply vacuum to the port at top of the flowmeter housing.

8. Go to step 6.19.2.5.

6.19.1.4 Cleaning procedure for assemblies with many small vent ports.

1. Remove the scavenger mounting screws.
2. Remove the scavenger flow control needle valve assembly. Inspect the needle valve and seat for lint or dust accumulation. Clean with compressed air if necessary.
3. Remove the hardware securing the flowmeter. Remove the brass retainer at the bottom of the assembly. Inspect the for lint or dust accumulation. Clean with compressed air if necessary.
4. Unthread the reservoir canister from the body.
5. Remove the hardware securing the tube assembly to the block. Inspect for lint or dust accumulation. Clean with compressed air if necessary and replace O-rings if necessary.
6. Probe all gas passages of the block to ensure there are no occlusions. Clean with compressed air if necessary.

6.19.1.5 Reassemble the scavenger assembly, attach the scavenger hose and reactivate the vacuum source.

6.19.2 OPEN RESERVOIR PRESSURE TESTING

6.19.2.1 Activate the Scavenger vacuum supply.

6.19.2.2 Turn the scavenger needle valve fully clockwise (closed).

6.19.2.3 Uncap the hose barb adapter at the rear of the scavenger and connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038). If the scavenger does not contain a hose barb adapter install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.

6.19.2.4 Interconnect the inspiratory and expiratory valves or expiratory port on the ultrasonic flow sensor, if applicable with a 22-mm hose.

6.19.2.5 Attach a Breathing System Leak Test Device (P/N S010159) to the bag mount.

6.19.2.6 Set the AUTO/BAG valve to the BAG position.

6.19.2.7 Open the APL valve.

6.19.2.8 Set the Oxygen flow on the anesthesia machine to 8 l/min.

6.19.2.9 The test pressure gauge shall indicate a pressure of less than 1.0 cm H_2O.

6.19.2.10 Close all flow control valves on the anesthesia machine.

6.19.2.11 Adjust the scavenger needle valve until the flowmeter indicates between the white lines.

6.19.2.12 What is the pressure on the test gauge? ___ cm H_2O (0 to -0.5)

6.19.2.13 Remove the test equipment, re-cap the scavenger adapter port or remove the scavenger adapter and reconnect the scavenger hose.

(✓) 6.20 A/C SCAVENGER - 6 Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.20.1 A/C SCAVENGER CLEANING

6.20.1.1 Remove the scavenger hoses and drain any accumulated moisture. Inspect the hoses for deterioration, then reinstall or replace it if needed.

6.20.1.2 Remove the safety relief valve housing by unscrewing it in a counter-clockwise direction.

6.20.1.3 Inspect the O-ring and replace it if needed.

6.20.1.4 Remove the safety relief valve from its housing by twisting it out in a counter-clockwise direction. The tips of needle nose pliers can be used to turn the valve. Be careful not to damage the valve's fragile disk.

6.20.1.5 Remove any accumulated lint or dust from the valve with a soft brush. The valve may be further cleaned with a low flow of Air or Oxygen. The scavenger body can be cleaned with a moist cloth.

6.20.1.6 Reinstall the valve into the housing, making sure that it is threaded all the way into the housing and that the plastic washer is properly seated on its upper surface.

6.20.1.7 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.20.2 AC SCAVENGER TESTING

6.20.2.1 Set the AUTO/BAG valve to the BAG position.

6.20.2.2 Open the APL valve.

6.20.2.3 Occlude the bag mount connector with a Breathing System Leak Test Device (P/N S010159).

6.20.2.4 Interconnect the inspiratory and expiratory valves or expiratory port on the ultrasonic flow sensor, if applicable with a 22-mm hose.

6.20.2.5 Set the Oxygen flow on the anesthesia machine to 8 l/min.

6.20.2.6 Install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.

6.20.2.7 Connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038).

6.20.2.8 Remove the transfer hose from the bottom of the scavenger and occlude this port.

6.20.2.9 What is the pressure on the test gauge? ___ cm H_2O (5 to 10)

6.20.2.10 Remove the test equipment and reconnect the scavenger hose and the transfer hose.

6.20.2.11 Close the Oxygen flow control valve.

(✓) 6.21 BAG SCAVENGER - Six Month Service Interval; Due Date _____, If applicable

NOTE: If the ambient air in the local environment contains a significant amount of dust and lint, the cleaning frequency must be increased to compensate for these conditions.

6.21.1 BAG SCAVENGER CLEANING

6.21.1.1 Remove the scavenger hoses and drain any accumulated moisture. Inspect the hoses for deterioration, then reinstall or replace as needed.

6.21.1.2 Remove the reservoir bag and drain any accumulated moisture and inspect it for deterioration, then reinstall or replace as needed. All under sized or single use bags must be replaced with 5-liter reusable style reservoir bag.

6.21.1.3 Remove the plastic valve cover on the front surface of the scavenger body by turning it in a counter-clockwise direction.

6.21.1.4 Remove the valve and washer from the scavenger body by turning it counter-clockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.21.1.5 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean Air or Oxygen.

6.21.1.6 Reinstall the plastic washer and valve into the scavenger body. Replace the valve cover.

6.21.1.7 Unscrew the valve housing on the left side of the scavenger body by turning its fitting counter-clockwise with a wrench.

6.21.1.8 Unscrew the valve from the housing by turning it in a counterclockwise direction.

6.21.1.9 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean Air or Oxygen.

6.21.1.10 Reinstall the valve in the housing, and then reinstall the housing into the scavenger body.

NOTE: This valve does not require washers or O-rings.

6.21.1.11 Remove the valve housing on the right side of the scavenger body by turning it counter-clockwise.

6.21.1.12 Inspect the rubber O-ring and replace if worn.

6.21.1.13 Remove the valve from the housing by turning it counterclockwise. A needle-nose pliers may be used to turn the valve, but use care not to damage the valve's fragile disk.

6.21.1.14 Brush any accumulated lint or dust off the valve with a soft brush. The valve may be further cleaned with a low flow of clean Air or Oxygen.

6.21.1.15 Reinstall the valve and plastic washer into the housing.

6.21.1.16 Reinstall the valve housing onto the scavenger body, making sure that the O-ring is properly seated.

6.21.2 BAG SCAVENGER TESTING

6.21.2.1 Activate the Scavenger vacuum supply.

6.21.2.2 Turn the scavenger needle valve fully clockwise (closed).

6.21.2.3 Install a scavenger adapter (P/N 4108114) between the 19-mm hose terminal on the scavenger and the scavenger hose.

6.21.2.4 Connect a test pressure monitor to the hose barb on the adapter using a PDM/Suction Adapter (P/N 4115038).

6.21.2.5 Set the AUTO/MAN valve to the BAG position.

6.21.2.6 Connect a 22mm breathing hose between the absorber's inspiratory valve and expiratory valve or expiratory hose terminal on the ultrasonic flow sensor, if applicable.

6.21.2.7 Open the APL valve.

6.21.2.8 Occlude the bag mount connector.

6.21.2.9 Press the O_2 Flush button to inflate the scavenger reservoir bag.

6.21.2.10 Open the Oxygen flow control valve to 8 l/min.

6.21.2.11 Does the reading on the test gauge indicate a pressure less than or equal to 10.0 cm H_2O? ___(Y)

6.21.2.12 Adjust the scavenger needle valve to allow typical suction through the scavenger.

6.21.2.13 Close all flow control valves on the machine.

6.21.2.14 Does the gauge indicate a pressure of less than or equal to -1.0 cm H_2O? ___(Y)

6.21.2.15 Remove the test equipment and reconnect the scavenger hose.

6.21.2.16 Close the Oxygen flow control valve.

(✓) 6.22 SUCTION REGULATOR - 6-month Service Interval; Due Date _____, If applicable

6.22.1 Set the vacuum on/off valve to the ON position.

6.22.2 Set the regulator to indicate 250 mm Hg.

6.22.3 Connect a digital pressure meter to the collecting inlet stem of the suction bottle.

6.22.4 Set the digital pressure meter to the mm Hg scale.

6.22.5 Is the vacuum indicated on the digital pressure meter within 200 to 300 mm Hg? ___ (Y)

6.22.6 Set the vacuum on/off valve to the OFF (vertical) position.

6.22.7 Turn the vacuum control knob fully counter-clockwise.

(✓) 6.23 MANUAL SPHYGMOMANOMETER - 6-month Service Interval; Due Date _____, If applicable

6.23.1 Insert the male Luer fitting of the Sphygmomanometer squeeze bulb hose assembly into the female Luer fitting labeled BP BULB on the front of the machine.

6.23.2 Insert an NIBP-Luer Test Adapter (P/N 4116111-001) inline between the blood pressure cuff and the extension hose.

6.23.3 Wrap the blood pressure cuff around an “E” cylinder.

6.23.4 Hand-pump the squeeze bulb until pressure of 200 mm Hg is indicated on the test gauge and start a stop watch.

6.23.5 Does the Sphygmomanometer indicate within 180 to 220 mm Hg? ___ (Y).

6.23.6 After thirty (30) seconds, is the pressure on the Sphygmomanometer gauge within 190 to 200 mm Hg? ___ (Y)

6.23.7 Remove test equipment.

6.23.8 Remove the blood pressure cuff from the “E” cylinder.

6.23.9 Does the Sphygmomanometer indicate within the band? ___ (Y)

6.24 FINAL TESTS

(✓) 6.24.1 Is the machine’s Operator’s Instruction manual in close proximity of the machine? ___ (Y)

6.24.2 Does the table lamp work properly if fitted? ___ (Y)

6.24.3 Verify all cylinder pressure gauges indicate zero.

6.24.4 Verify the pipeline hoses are connected to the hospital pipeline.

6.24.5 Verify the APL valve knob is turned completely counterclockwise (fully open).

6.24.6 Place the AUTO/BAG selector in the BAG position.

6.24.7 Verify the ventilator hose is connected between the Auto/Man valve and Ventilator hose terminal.

6.24.8 Verify the pressure pilot line is connected between the machine interface and absorber.

6.24.9 Verify the Oxygen sensor is removed from the inspriatory valve dome adapter.

6.24.10 Verify the inspriatory valve dome is plugged.

6.24.11 Unplug the machine's AC power cord. Is the "AC PWR FAIL" LED lighted? ___(Y) Press and hold the "BATTERY TEST" button. Is green Battery Test LED lighted? ___ (Y)

6.24.12 Plug the power cord back into the original AC receptacle.

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

7.0 SOFTWARE UPDATE PROCEDURE

This section outlines the software installation procedure, including the equipment needed and its connections.

Software updates to the Narkomed GS anesthesia system are done through a serial port connection to an external PC using the batch file LOADGS.BAT.

7.1 SOFTWARE TRANSFER TO PC VIA MODEM

Equipment required:

--Interface Cable, NAD Part No. 4109882 P (9-pin to 25-
or 4110328 A (9-pin to 9-pin)

--IBM® PC or IBM PC Compatible configured with:

- PC-DOS or MS-DOS V3.3 or higher
- RS-232C Serial Port connected to COM 1
- Hard Drive or Floppy Drive
- Modem (or external modem)

7.1.1 Download the software to the hard disk or use Drive A (floppy drive) on the PC.

7.2 INSTALLING NMGS SOFTWARE FROM A PC

7.2.1 Set the System Power switch on the NARKOMED GS to STANDBY, and the power switch on the PC to OFF.

7.2.2 Connect the appropriate interface cable (9-pin or 25-pin) to COM 1 on the PC, and connect the other end of the cable to the NMGS serial interface Port as shown in Figure 7-1.

7.2.3 Power up the PC and wait for the DOS prompt to appear on the screen.

7.2.4 Set the PC to read the drive holding the software. For example: if the software was downloaded to drive A, type A: and press ENTER.

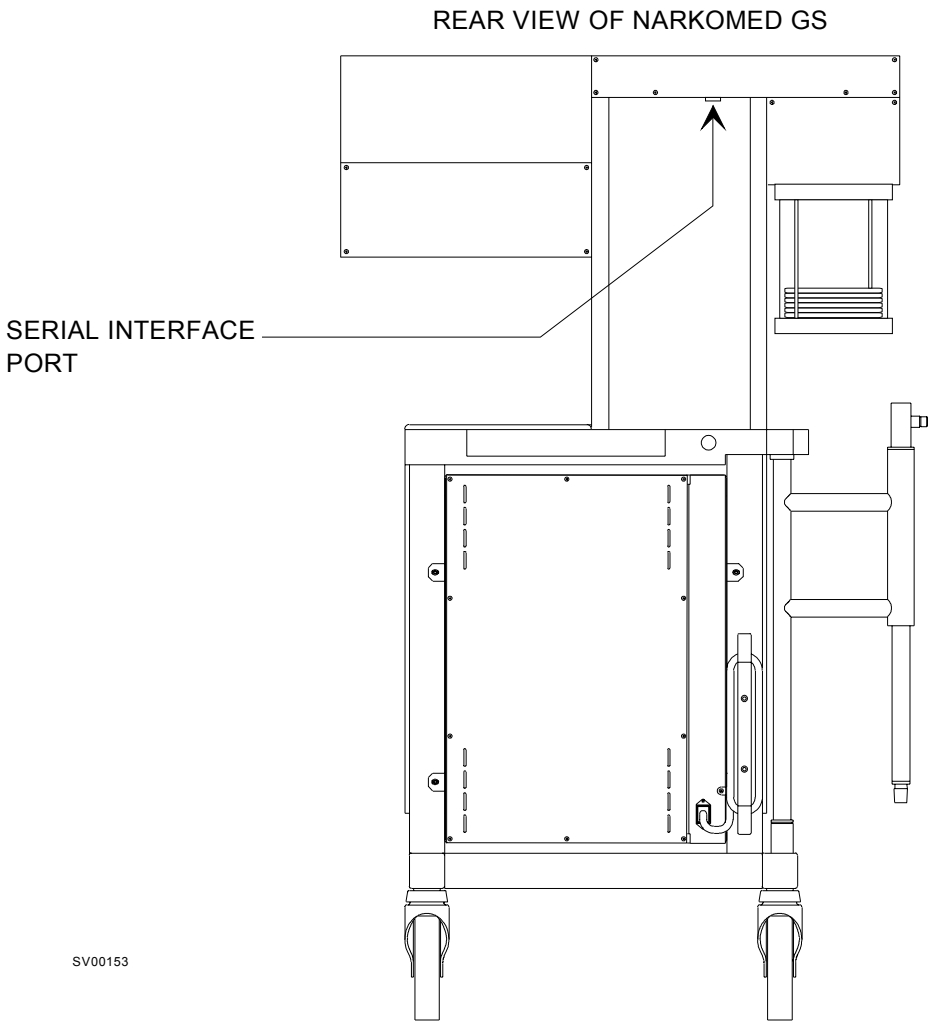


FIGURE 7-1. Narkomed GS Serial Port Location

7.2.5 Type LOADNMGS and press ENTER.

7.2.6 Turn the System Power switch to ON.

7.2.7 As the software is downloading, the incremental number of bytes sent will be displayed on the PC screen. When the download is complete, the PC screen will display

```
\       Bytes sent:    0    Images sent:    1
```

Software installation is complete when the machine resets.

7.2.8 Set the System Power switch on the NMGS to STANDBY, and the power switch on the PC to OFF. Disconnect the interface cable.

8.0 Spare and Replacement Parts

Part numbers for field-replaceable items on the Narkomed GS anesthesia system are listed on the following pages, along with part numbers for related hardware and cables.

The item numbers are keyed to the accompanying illustrations to aid in identifying the item and its location.

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Power Supply, Battery in display box (early design) 8-37A, 8-37B
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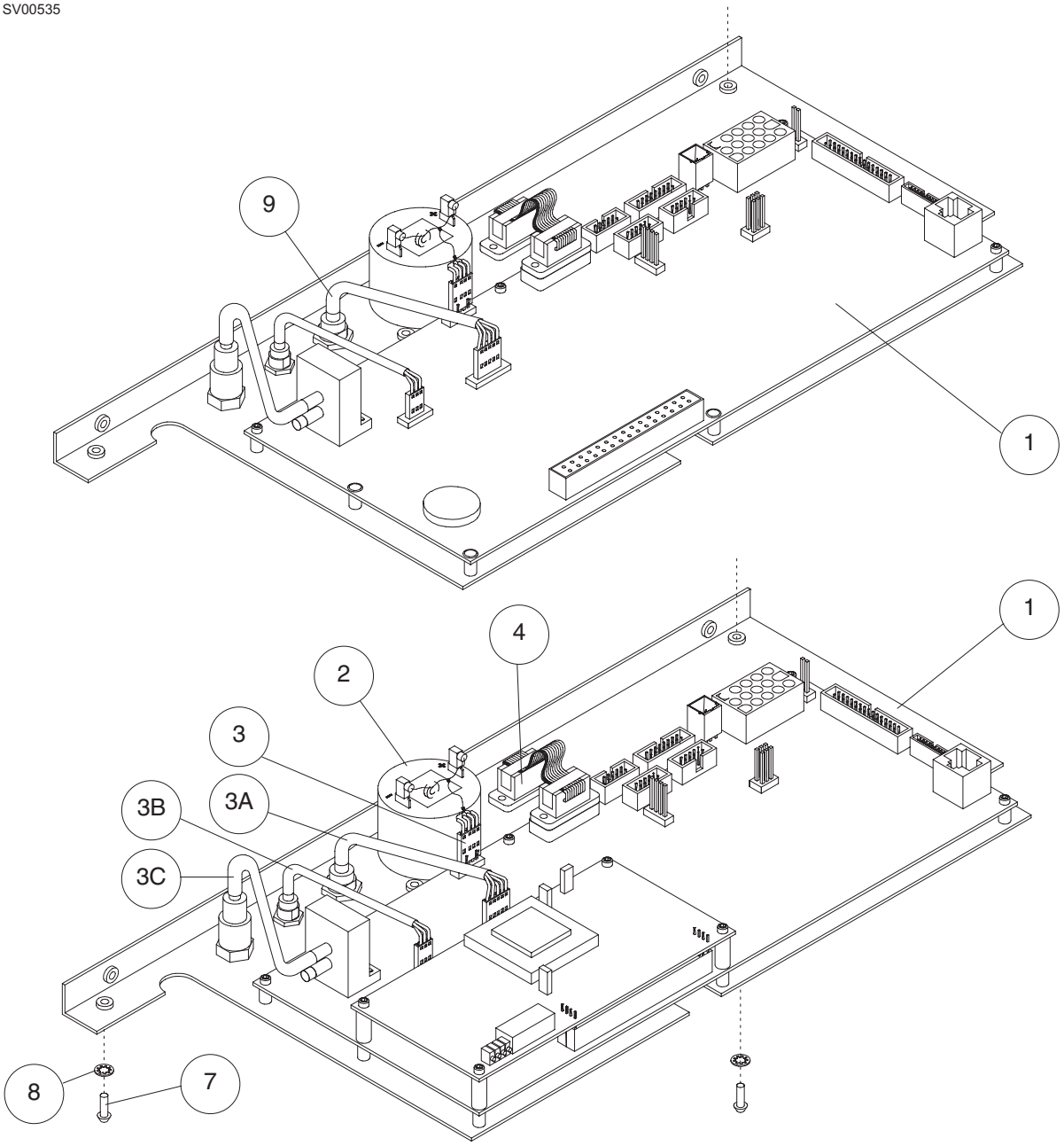
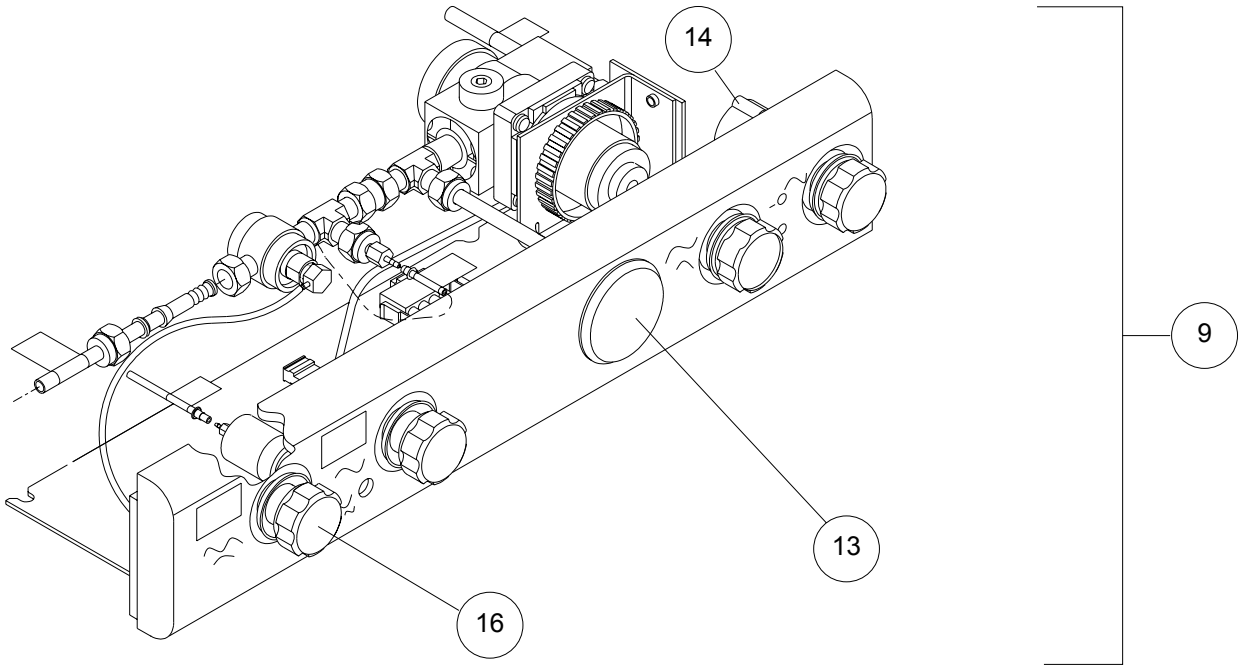
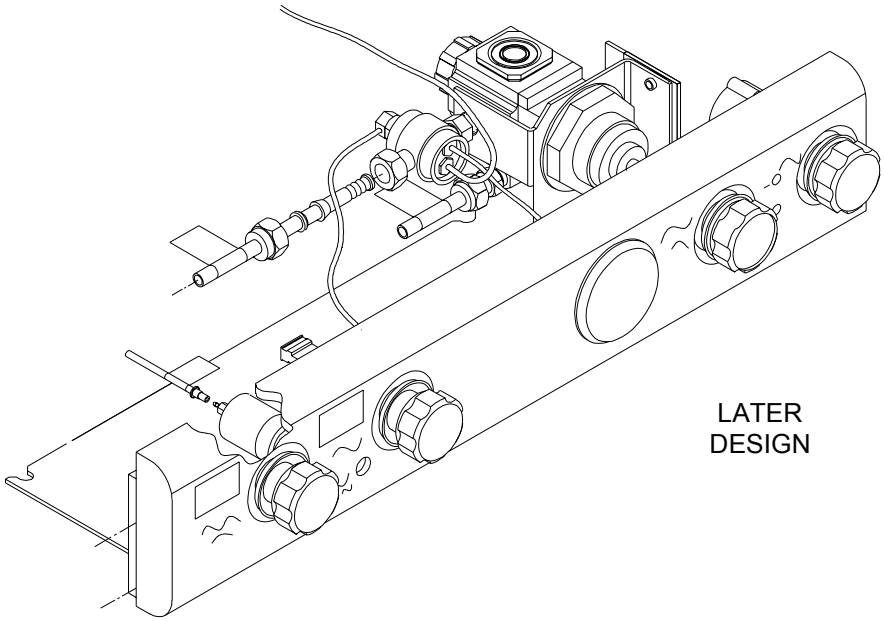
SV00535



ITEM	DESCRIPTION	PART NUMBER
1.	Processor Assembly (Ventilation Monitor Asm)	SE4113780-001, 4113780-001
2.	Speaker	4106335
3.	Speaker Wire Harness	4112169-001
3A	Volume Interface Cable Assembly	4113910
3B	O_2 Interface Cable Assembly	4113909
3C	Hose, 0.13 ID, 8 in.	ML08007
	Fitting, 0.13 hose x ⅛ MPT	4102963
	Nut, Panel 9/16 - 18	4108156
	Quick-disconnect Fitting	4108155
4.	Serial Port Connector and Cable Assembly	4113760
5.	Deleted	
6.	Deleted	
7.	Screw, 6-32 x ⅜ in. btn hd (3x)	HW09000
8.	Lock Washer, #6 int-t (3x)	HW67015
9.	Cable Assembly, Spirocell, NMGS	4114429
10.	Deleted	

NOTE: Processor assembly (Item 1) could be made up of two PCBs: 4113549 and 4113595, or a single PCB, 4114967. They are interchangeable. The single PCB style is the later design.



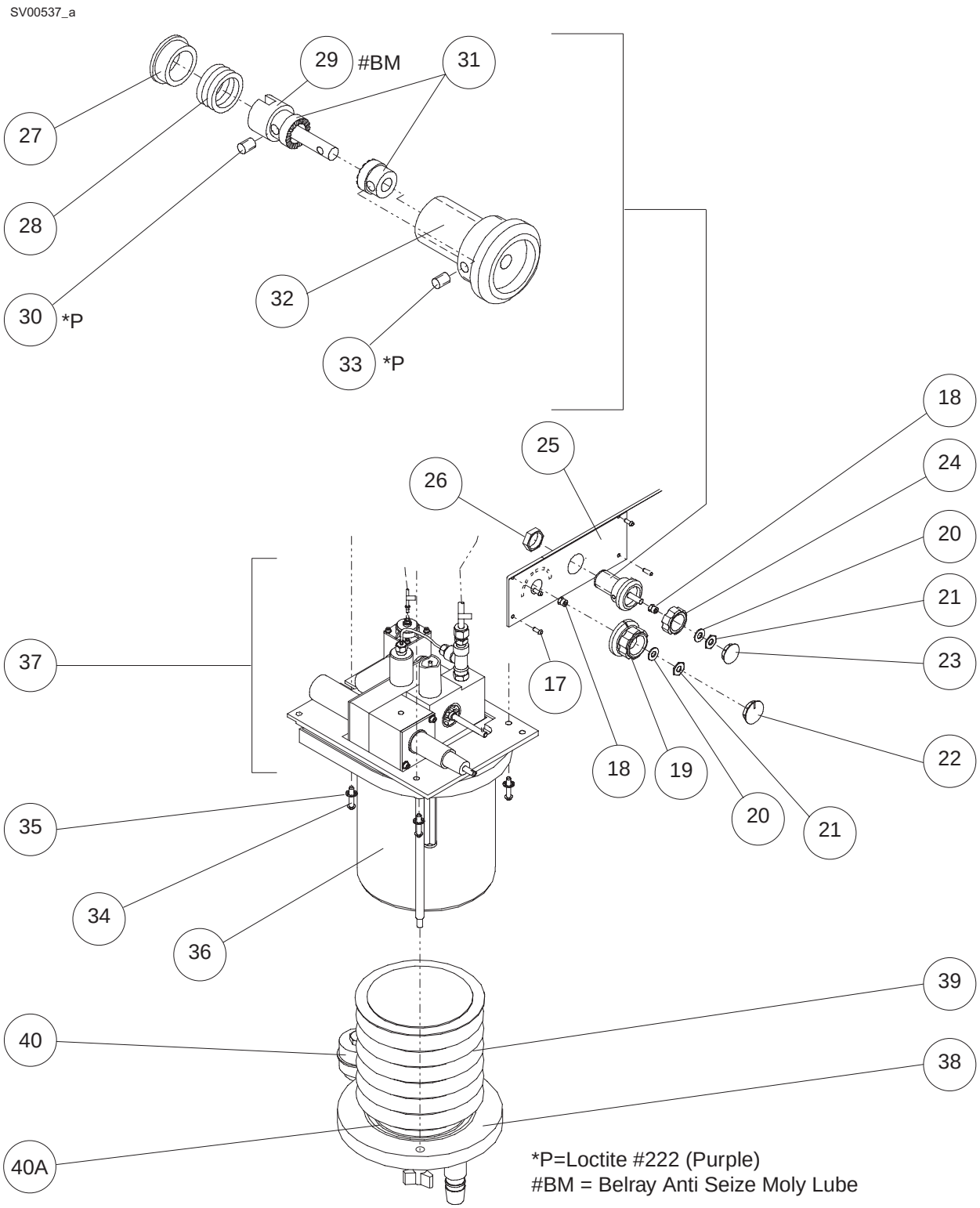


LATER
DESIGN

SV00119

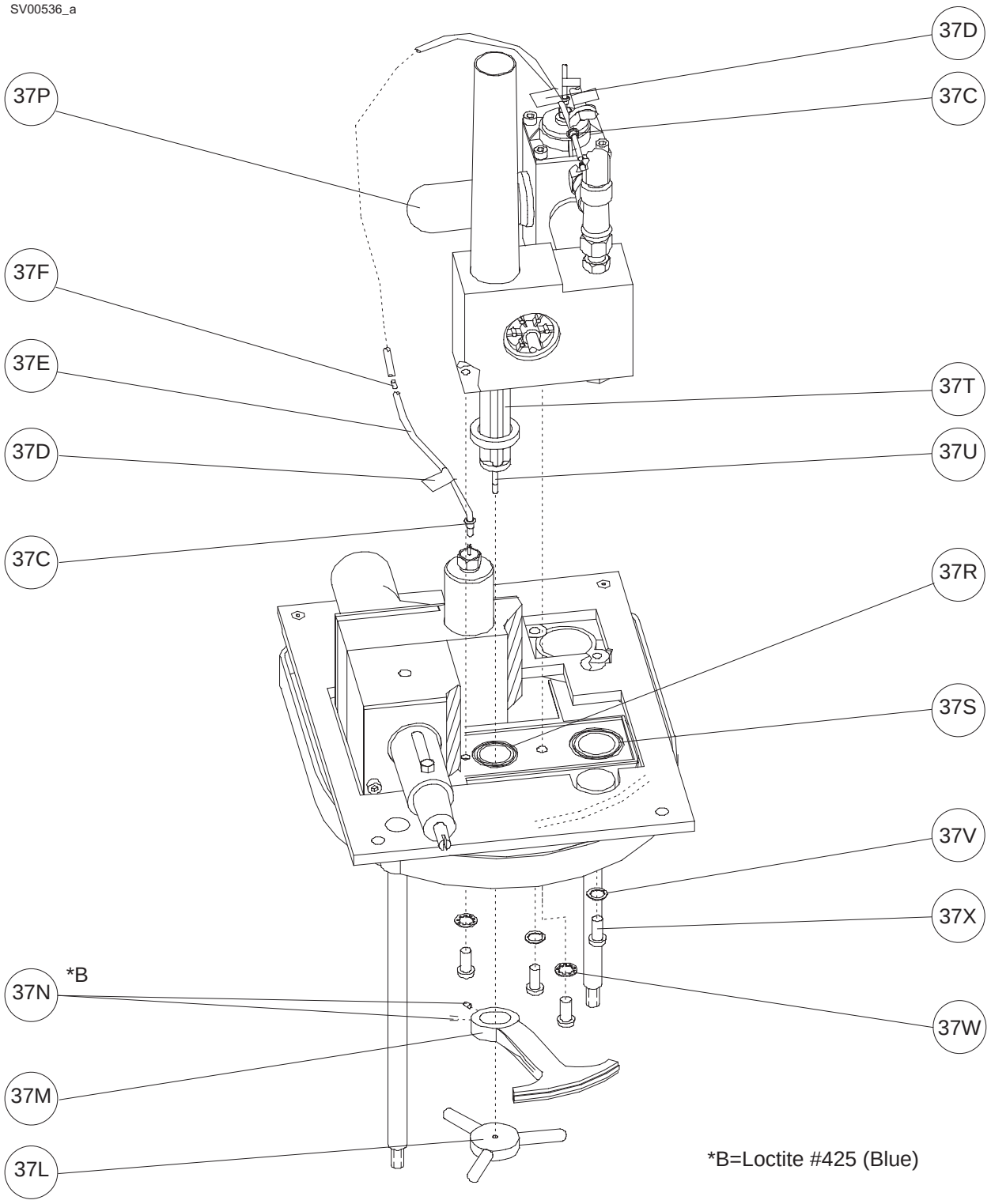
ITEM	DESCRIPTION	PART NUMBER
9	AV2+ Ventilator Controller Assembly (Bezel Assembly)	NAD color 4113132-001 Euro color 4113132-005
13	Gauge	4112251-001
14	On-off switch & wire harness	4113136
16	Knob (4x)	4113281
	Knob Cover (3x) (all except ON-OFF switch)	4113278-002
	Knob Cover (ON-OFF switch)	4113278-003
(Not shown)	Cable Assembly, Man/Auto Sensor Interface	4113908
	Regulator rebuild kit	4118241

SPARE AND REPLACEMENT PARTS (continued) NMGS

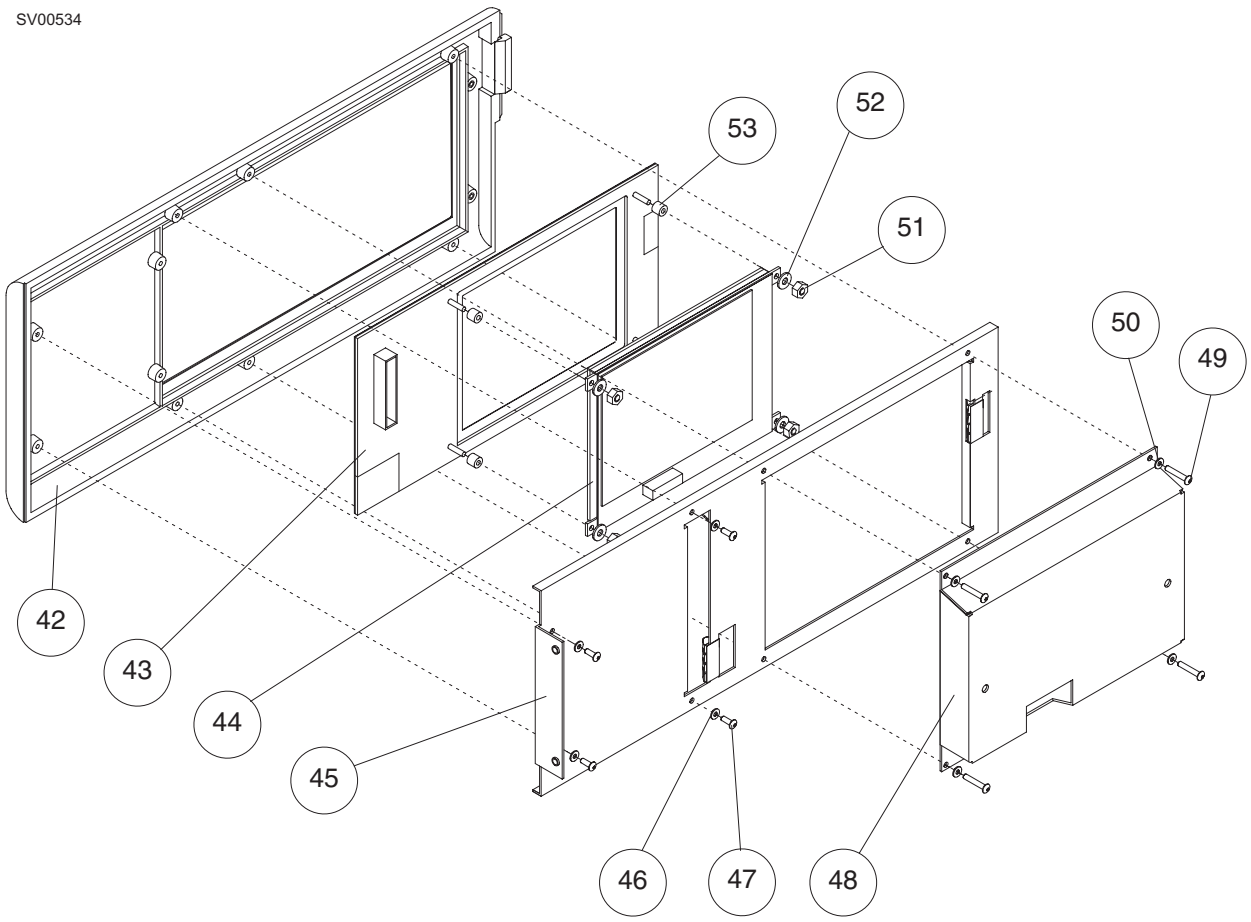


ITEM	DESCRIPTION	PART NUMBER
17	Screw, 6-32 x ⅜ in. Btn Hd Skt (4x)	HW09000
18	Collet	4112167
19	Knob, PLC Adj.	4113279
20	Flat Washer, #10	HW66003
21	Hex Nut, M5 x 0.5	4112066
22	Knob Cover	4113278-002
23	Knob Cover	4113278-002
24	Knob	4113280
25	Front Plate, Bellows Box	4112230
26	Panel Nut	4107460
27	Spring Retainer	4107546
28	Spring	4110975
29	Shaft	4112175
30	Set Screw, 6-32 x 3/16 in.	HW07002
31	Clutch	4107544
32	Housing	4112467
33	Set Screw, 6-32 x ¼ in.	HW04003
34	Screw, ¼-20 x 1 in. Btn Hd Skt (3x)	HW09057
35	Lock Washer, ¼ int-t (3x)	HW67017
36	Canister	4106948
	Tidal Volume Indicator	4108276
	Bellows Guide	4110735
37	Bellows Valve Assembly (Parts Breakdown listed on a subsequent page)	4112272
	Bellows Valve Assembly, Service Exchange	SE4112272-S01
38	Bellows Assembly, Adult	4106935
	Tested Assembly	4106935-S01
39	Bellows Sub-assembly, Adult	4106930
	Urethane (Non-Latex) Bellows Sub-assembly, Adult	4106930-001
	O-ring #217 (neoprene)	4101817
40	Relief Valve Assembly	4108050
	Diaphragm Assembly	4110960
40A	Gasket, bottom	4105849

SPARE AND REPLACEMENT PARTS (continued) NMGS



ITEM	DESCRIPTION	PART NUMBER
37	(Ref) Bellows Valve Assembly	4112272
	Service Exchange	SE4112272-S01
37C	Press-on Hose Clamp (2x)	4104161
37D	Label, O_2 Tubing (2x)	4109871
37E	Hose, 0.075 I.D.	ML08003
37F	Restrictor	4107639
37L	Bellows Top Guide	4110735
37M	Volume Indicator	4108276
37N	Set Screw, 6-32 x ¼ in. cup point (2x)	HW04003
37P	Silencer, pneumatic, 3/8 NPT	4109819
37R	O-ring, #19 silicone	4107096
37S	O-ring, #22 neoprene	4104595
37T	Rod, bellows adjust	4110727
37U	Rod	4106418
37V	Lock washer, #8 split	HW65001
37W	Lock washer, #8 int-t	HW67000
37X	Screw, 8-32 x 3/8 in. btn hd skt	HW09008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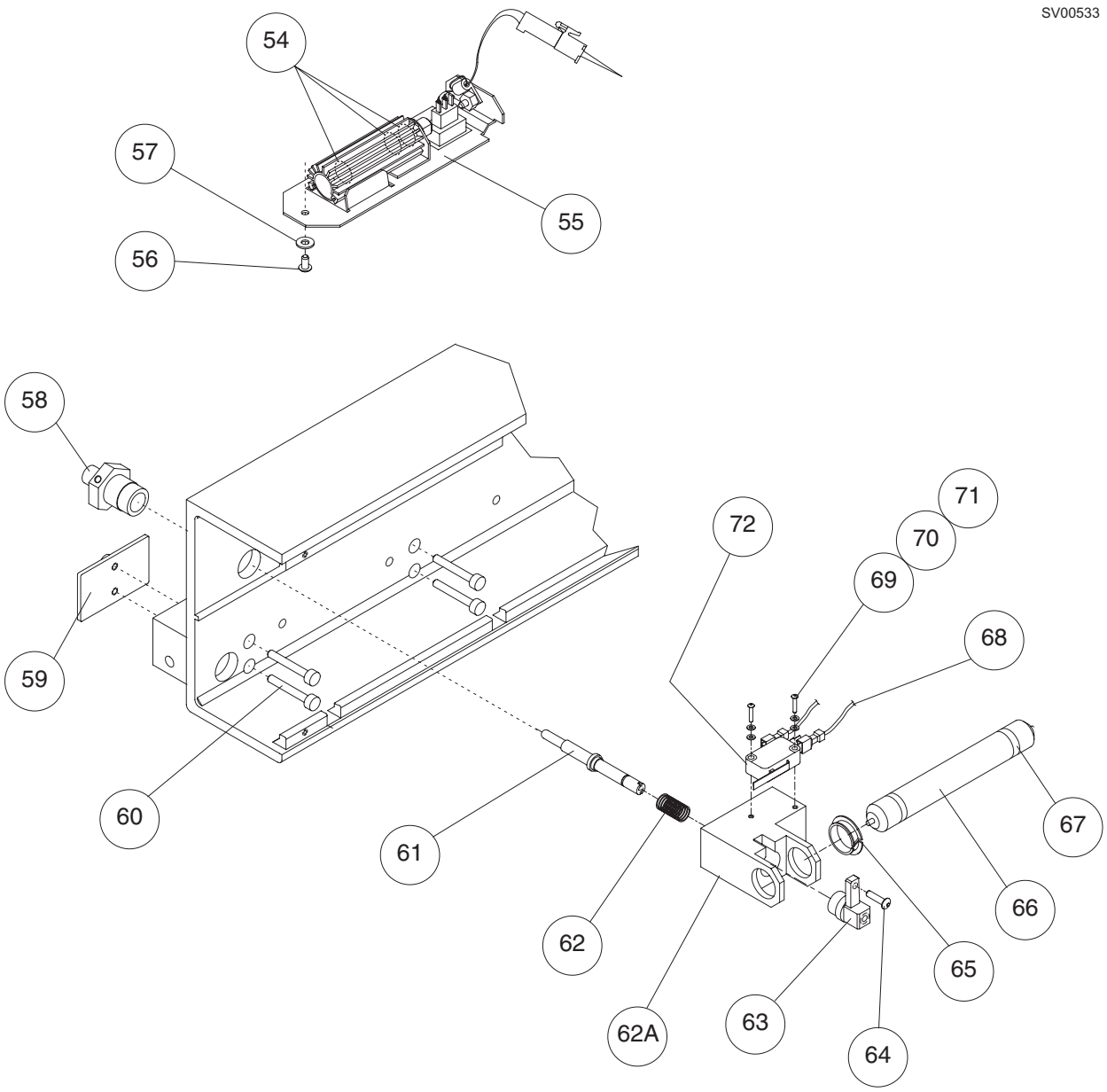
ITEM	DESCRIPTION	PART NUMBER
41	Deleted	
42	Bezel, 2-vapor machine, black	4113741-001
	Bezel, 2-vapor machine, euro blue	4113741-003
	Bezel, 3-vapor machine, black	4113741-002
	Bezel, 3-vapor machine, euro blue	4113741-004
43	Keypad (switch panel)	4113715
44	Display Panel	4113755
45	Bezel Plate, 2-vapor machine	4113742-001
	Bezel Plate, 3-vapor machine	4113742-002
46	Lock Washer, #4 int-t (4x)	HW67011
47	Screw, 4-40 x 5/16 in. btn hd (4x)	HW09014
48	Display Panel Cover	4113726
49	Screw, 4-40 x 5/16 in. btn hd (4x)	HW09014
50	Lock Washer, #4 int-t (4x)	HW67011
51	Hex Nut, 4-40 (4x)	HW50002
52	Lock Washer, #4 int-t (4x)	HW67011
53	Spacer (4x)	4113200-001
	Keypad Cable, 30-cond. ribbon	4113763
	Display Panel Cable, 20-cond. ribbon	4113762-001


SV00533
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62A
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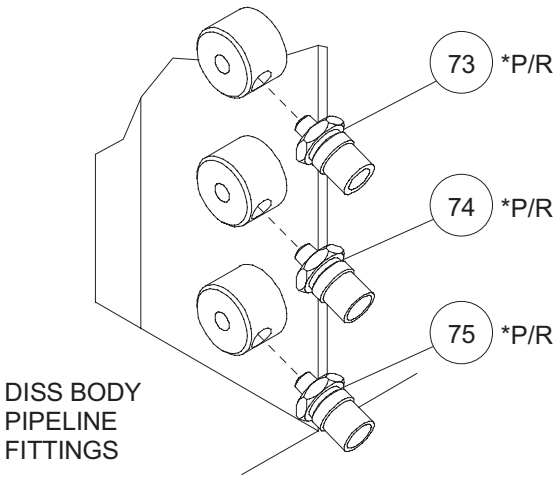
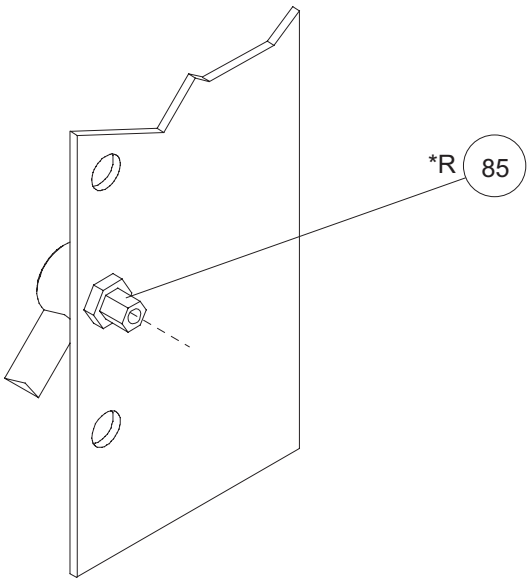
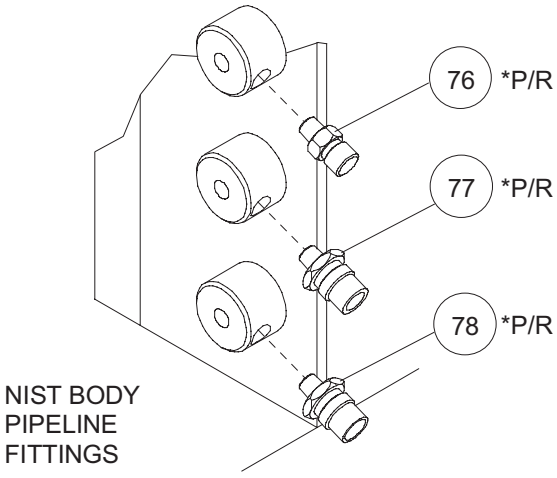
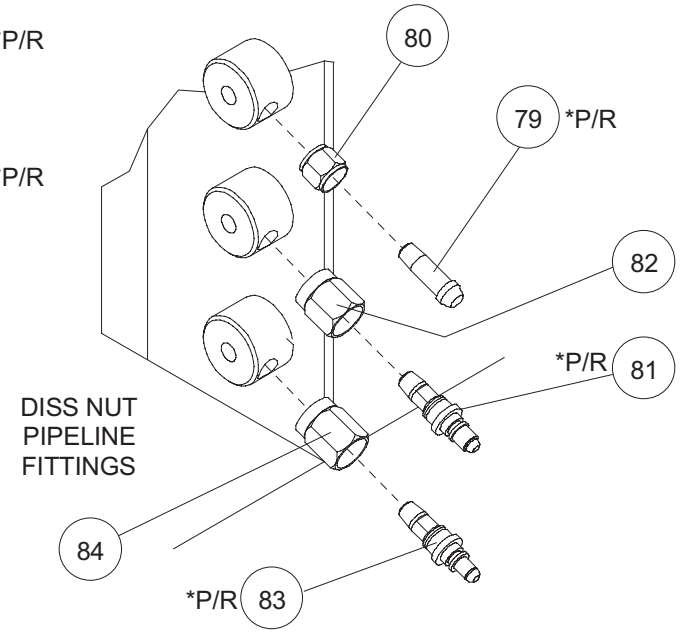
ITEM	DESCRIPTION	PART NUMBER
54	Heat Sink O-rings (3x)	M09361
55	Lamp and Switch Assembly, NAD color	4113785
	Lamp and Switch Assembly, Euro color	4113785-001
	Lamp	4114114
56	Screw, 6-32 x 5/16 in. btn hd	HW09022
57	Lock Washer, #6 int-t	HW67015
58	Bushing	4114721
59	Cover, Vapor Block	4112699
60	Vaporizer Mounting Screws, M4-0.7 x 1 3/16 cap skt hd	HW01072
61	Plunger	4114722
62	Spring	4110975-029
62A	Block, Exclusion	4113739
63	Rear Plunger Block	4113754
64	Screw, 6-32 x 7/16 in. pan hd sltd, nylon	HW02045
65	Bearing, Nylon (2x per shaft)	4113736
66	Shaft	4113733
67	Retaining Ring (2x per shaft)	4113850-001
68	Cable Assembly, 3-vapor machine	4113766-002
	Cable Assembly, 2-vapor machine	4113766-001
69	Screw, 4-40 x ⅝ in. cap skt hd (2x per switch)	HW01004
70	Lock Washer, #4 int-t (2x per switch)	HW67011
71	Flat Washer, #4 (2x per switch)	HW66001
72	Microswitch	4113735





*P/R = Loctite #747 (Primer T) & Loctite #271 (Red)
*R = Loctite #271 (Red)





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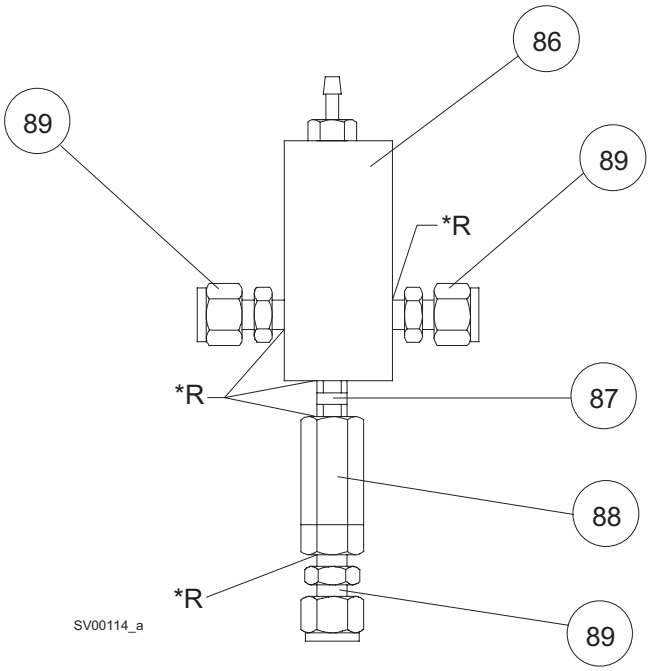
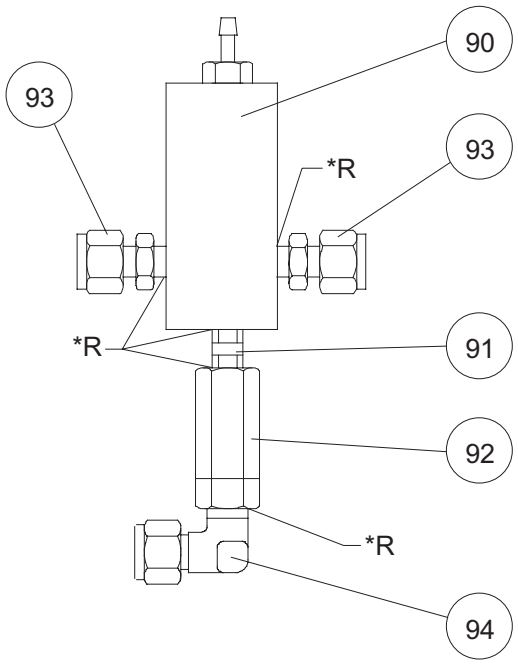
ITEM	DESCRIPTION	PART NUMBER
	DISS Body Pipeline Fittings:	
73	O_2 DISS Fitting	4102563
74	Air DISS Fitting	4102886
75	N_2O DISS Fitting	4111384
	NIST Body Pipeline Fittings:	
76	O_2 Male NIST Connector	4110388
77	Air Male NIST Connector	4110386
78	N_2O Male NIST Connector	4111382
	DISS Nut Pipeline Fittings:	
79	O_2 DISS Nipple	4103877
80	O_2 DISS Nut	4102848
81	Air DISS Nipple	4111385
82	Air DISS Nut	4103120
83	N_2O DISS Nipple	4111383
84	N_2O DISS Nut	4102850
85	Pipeline Inlet Filter Asm (Typ., All Inlets)	4106198
	O-ring for N_2O DISS Nipple	4113494
	Pipeline Inlet Housing (old no.)	4113363
	Pipeline Inlet Housing (new part w/o recess for label)	4113974

N2O FAILSAFE ASSEMBLY



AIR OR THIRD GAS FAILSAFE ASSEMBLY

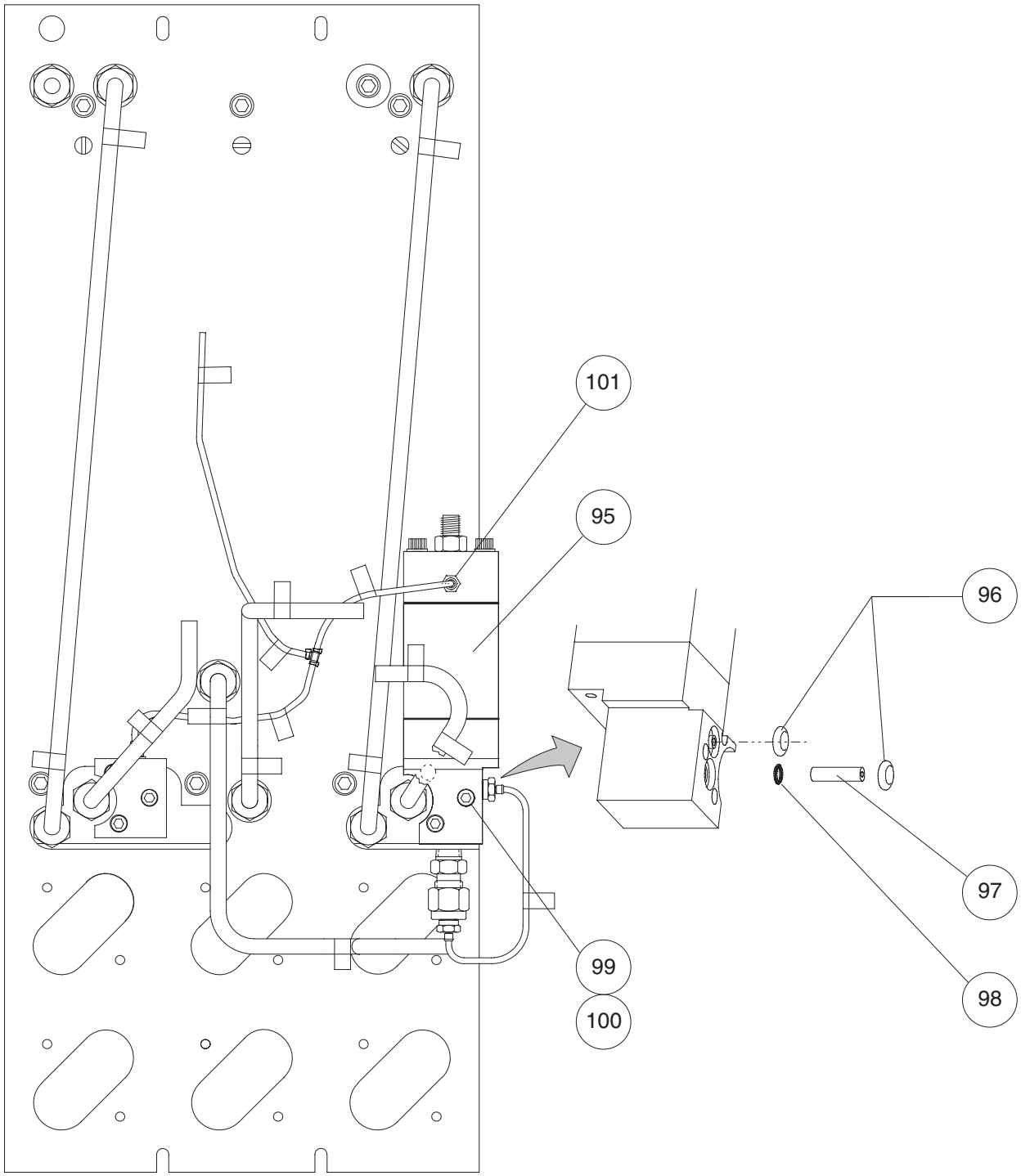


*R = Loctite #271 (Red)

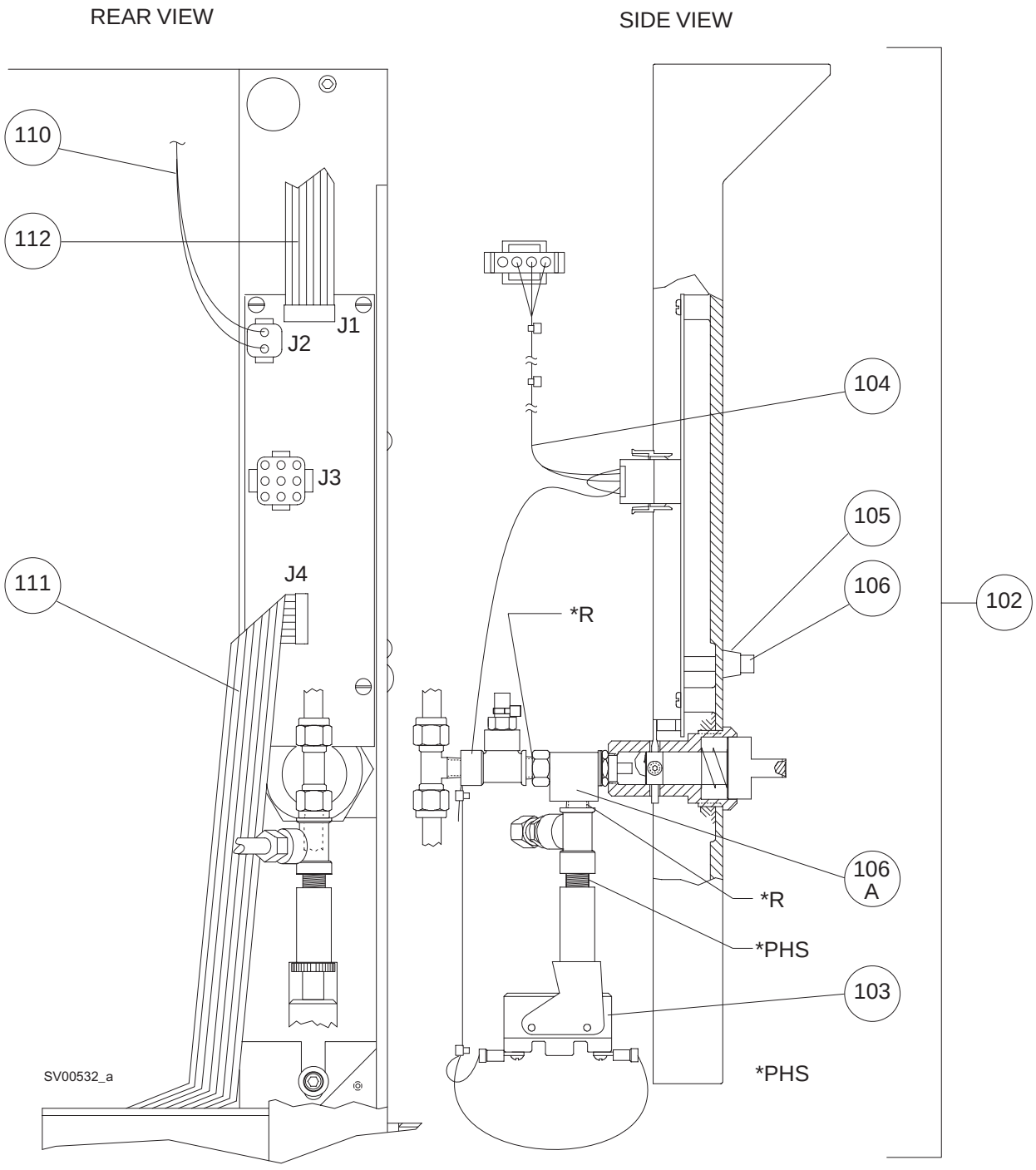
ITEM	DESCRIPTION	PART NUMBER
	N_2O Failsafe Assembly:	
86	Failsafe Block Asembly	4112043
87	Nipple, ⅛ NPT x ¾ in.	4102784
88	Check Valve, MJCV-1	4105815
89	Straight Fitting, ¼Tube x ⅛ MPT (3x)	4109408
	Air or 3rd Gas Failsafe Assembly:	
90	Failsafe Block Asembly	4112043
91	Nipple, ⅛ NPT x ¾ in.	4102784
92	Check Valve, MJCV-1	4105815
93	Straight Fitting, ¼Tube x ⅛ MPT (2x)	4109408
94	Elbow Fitting, ¼Tube x ⅛ MPT	4109410

REAR VIEW OF FLOWMETER HOUSING
WITH REAR COVER REMOVED

SV00541

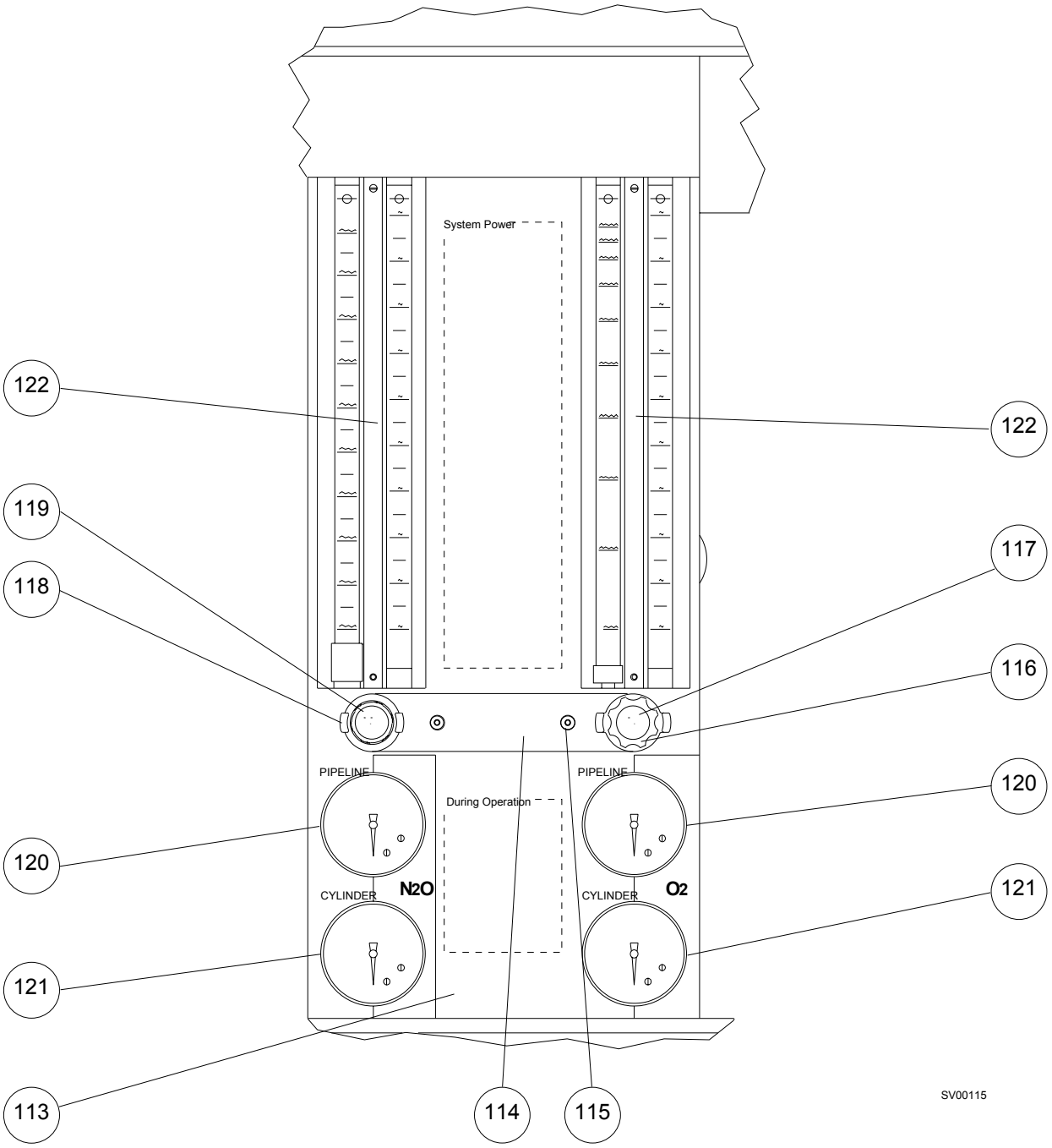


ITEM	DESCRIPTION	PART NUMBER
95	ORC Assembly (low flow design)	4113329-001
	ORC Assembly (low flow design) Service Exchange	SE4113329-001
96	O-ring, #105 (Neoprene) (2x)	4111893
97	Filter	4111805
98	O-ring, 0.066 x 0.042 (Buna-n)	4111894
99	Screw, 8-32 x 1½ in. skt hd (3x)	HW01020
100	Lock Washer, #8 split (3x)	HW65001
101	Hose Clamp, Press-on (3x)	4104161



*PHS = Loctite #545 (Pneumatic / Hydraulic Seal)
*R = Loctite #271 (Red)

ITEM	DESCRIPTION	PART NUMBER
102	Alarm Channel Assembly	NAD color SE10029; Euro color SE10029-001
103	Oxygen Supply Pressure Alarm Switch	4106037
104	Wire Harness, Alarm Switch & J3 to Ventilator Controller J2	4112185
105	Housing, Push Button	4106046
106	Cap, Push Button	4106047
106A	Clippard valve	4103588
110	Wire Harness, Flowmeter Lights to Alarm Channel J2	4108594
111	Cable Assembly, Power Supply J2 to Alarm Channel J4	4112149-001
112	Cable Assembly, Alarm Channel J1 to Processor J105	4113081-003


System Power
PIPELINE
During Operation
PIPELINE
CYLINDER
N2O
CYLINDER
O2
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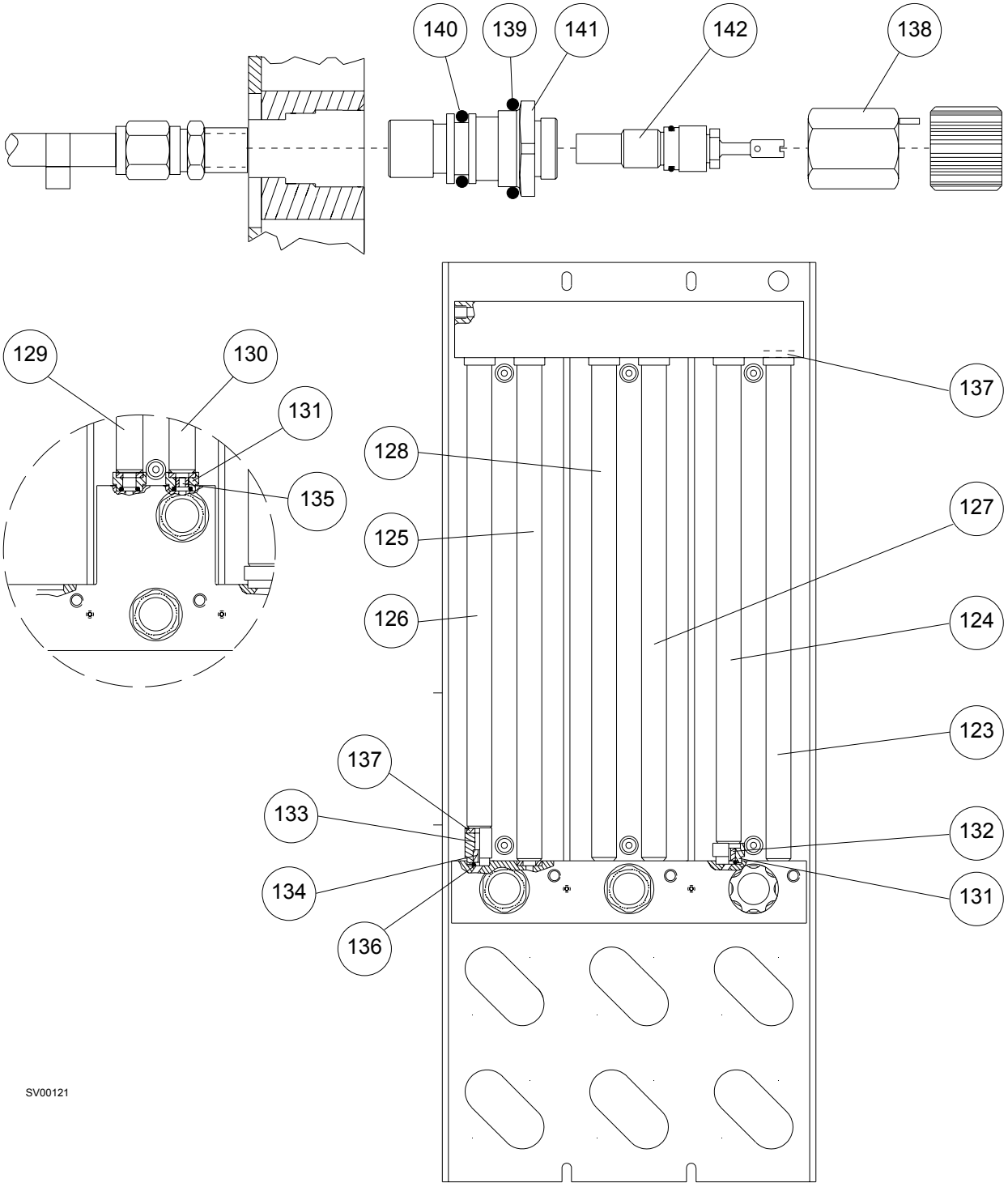
SV00115

ITEM	DESCRIPTION	PART NUMBER
113	Shield, Flowmeter, 2 Gas N_2O/O_2, Domestic	4111824-001
	Shield, Flowmeter, 2 Gas N_2O/O_2, Canada	4111824-002
	Shield, Flowmeter, 2 Gas, Export	4111825
	Shield, Flowmeter, 3 Gas Air, Domestic	4111830-001
	Shield, Flowmeter, 3 Gas O_2-He, Domestic	4111831
	Shield, Flowmeter, 3 Gas Air, Canada	4111830-002
	Shield, Flowmeter, 3 Gas, Export, 6 Gauge	4111826
	Shield, Flowmeter, 3 Gas, Export, 5 Gauge	4111827
	Shield, Flowmeter, 4 Gas, Air/CO_2, Domestic	4111829-003
	Shield, Flowmeter, 4 Gas, Air/O_2-He, Domestic	4111829-001
	Shield, Flowmeter, 4 Gas, Air/O_2-He, Canada	4111829-002
	Shield, Flowmeter, 4 Gas, Export	4111828
114	Knob Guard, 2 Gas	4110621
	Knob Guard, 3 Gas	4110574
115	Screw, 6-32 x 7/16 btn hd (2x)	HW09017
116	Knob, O_2	4103156
117	Label, O_2 Flow Control Knob, Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
118	Knob, Flow	4103736
119	Label, N_2O Flow Control Knob, Blue (USA, UK, Canada)	4103904
	Gray (Germany)	4111266-004
	Label, Air Flow Control Knob,Yellow (USA, Germany)	4103905
	Black/White (UK, Canada)	4105982
	Label, CO_2 Flow Control Knob, Gray (USA,UK, Canada)	4103908
	Black (Germany)	4111266-006
	Label, O_2-He Flow Control Knob,Green/Brown (USA)	4110951
	White/Brown (Canada)	4110952
120	Gauge, 100 psi	4110575-001
	Gauge, 7.0 bar	4110575-003
121	Gauge, 3000 psi	4110575-002
	Gauge,200 bar	4110575-004
122	Flowmeter Light Circuit Assembly	4107370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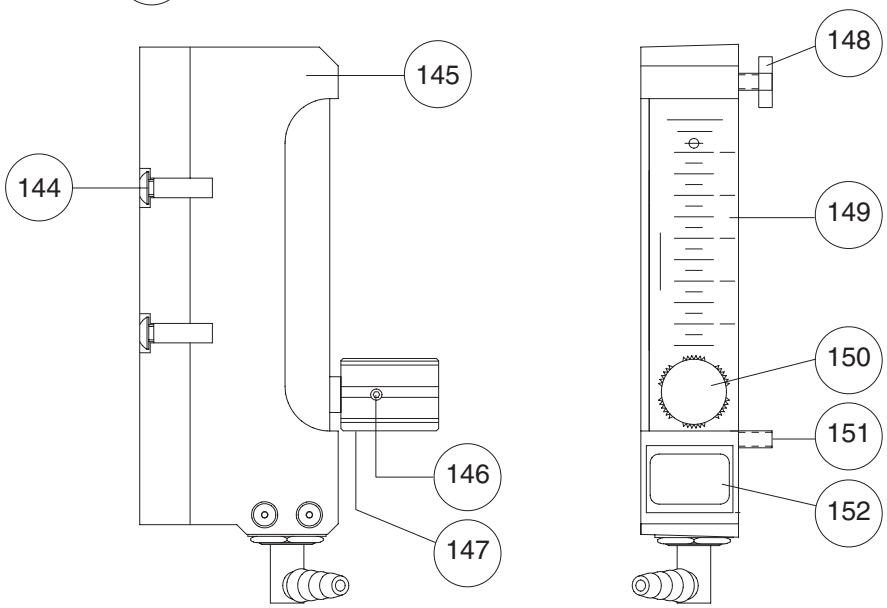
SV00121

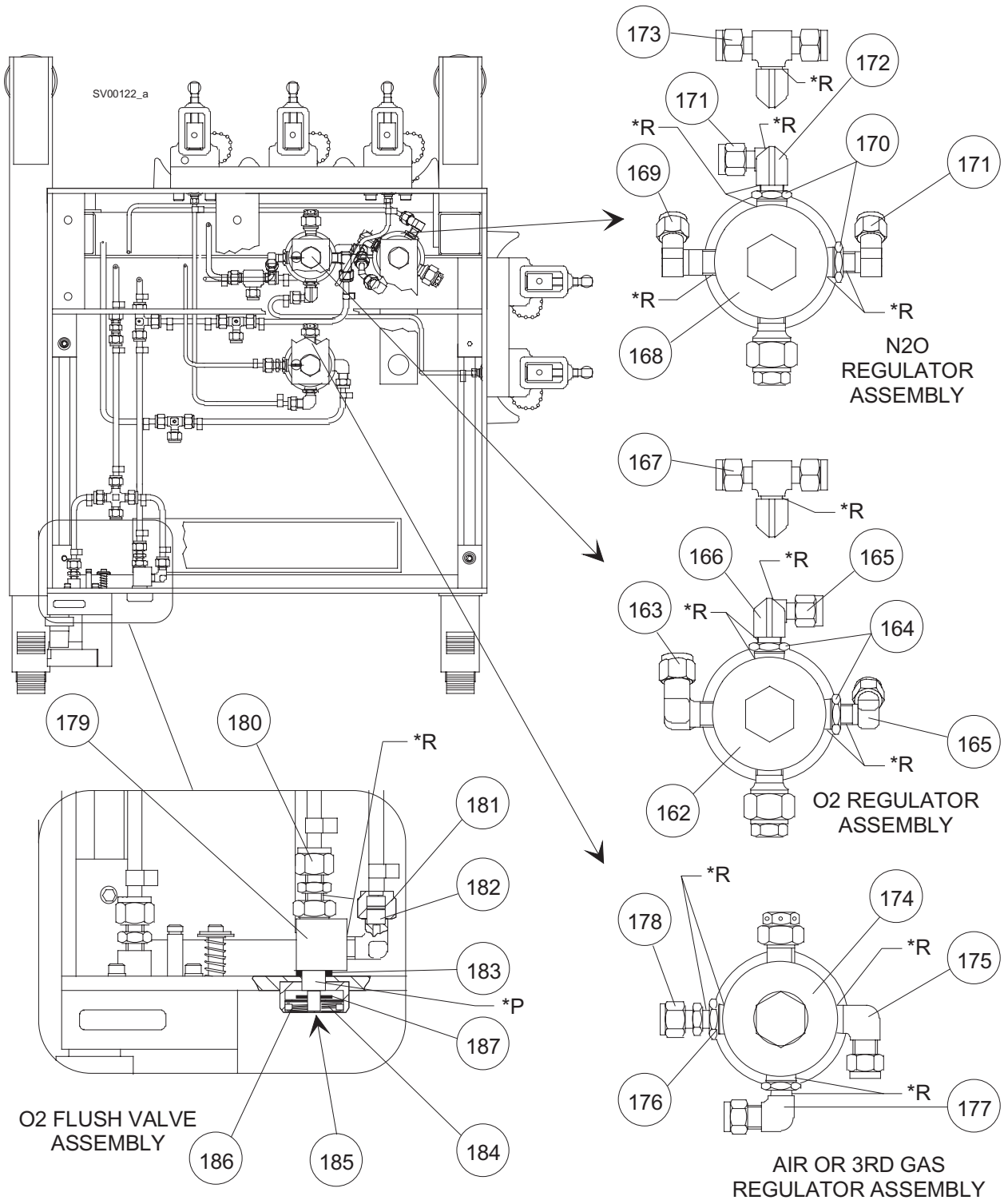
ITEM	DESCRIPTION	PART NUMBER
123	Flow Tube, O_2, 1-10 l/min	4112560-001
	Flow Tube, O_2, 0.6-10 l/min (Low Flow)	4112568-001
124	Flow Tube, O_2, 100-1000 ml/min	4112559-001
	Flow Tube, O_2, 20-500 ml/min (Low Flow)	4112567-001
125	Flow Tube, N_2O, 1-10 l/min	4112562-001
	Flow Tube, N_2O, 0.6-10 l/min (Low Flow)	4112564-001
126	Flow Tube, N_2O, 100-1000 ml/min	4112561-001
	Flow Tube, N_2O, 20-500 ml/min (Low Flow)	4112563-001
127	Flow Tube, Air, 1-10 l/min	4112566-001
128	Flow Tube, Air, 100-1000 ml/min	4112565-001
129	Flow Tube, Air, 0.2-10 l/min (4-gas machines)	4112558-001
130	Flow Tube, CO_2, 0.05-1.0 l/min (4-gas machines)	4112557-001
	Flow Tube, O_2-He, 2-10 l/min (4-gas machines)	4112569-001
131	O_2 Restrictor Housing	4103440
132	O_2 Restrictor, Red	4110738-003
133	N_2O Restrictor Housing	4111716
134	N_2O Restrictor, Black	4110738-005
135	Restrictor, Yellow (CO_2 only)	4110738-006
136	O-ring, #010, Neoprene (one per each restrictor housing)	4101872
137	Gasket, Large, 2x per Flow Tube	4102724
	Parts common to all flow control valves:	
138	Stop Pin Nut	4103382
139	O-ring, #018, Neoprene	4102336
140	O-ring, #112, Neoprene	4102141
141	Insert, Flow Control Valve	4111819
142	Valve, Flow Control	4103352
	New part number	4115871

143 AUXILIARY O2 FLOW METER, NEW STYLE



SV00531

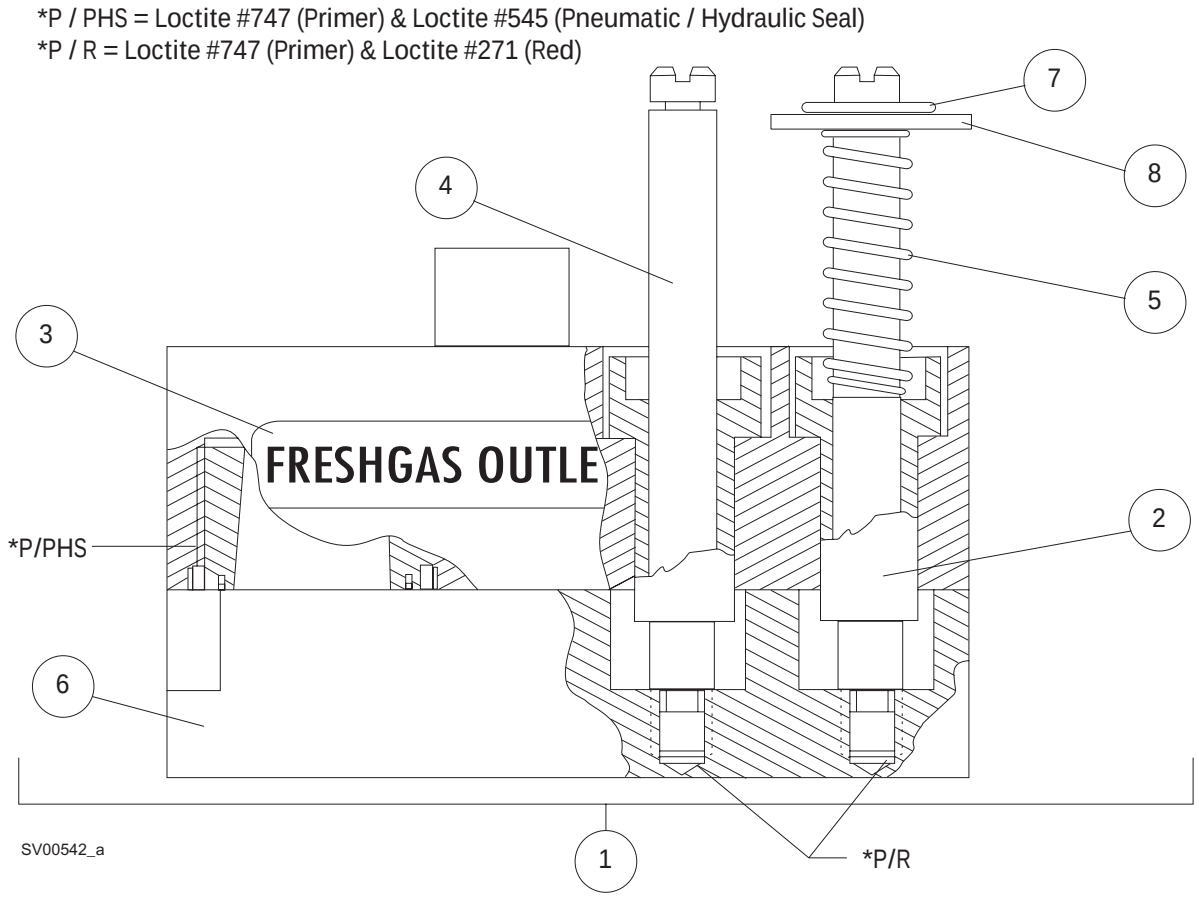
ITEM	DESCRIPTION	PART NUMBER
143	Auxiliary O_2 Flow Meter Assembly, new style	4109310
144	Screw, 10-32 x 1 1/16 in. btn hd (2x)	HW09043
145	Housing	4111053
146	Set Screw, cup point, 6-32 x ¼ in.	HW04003
147	Knob	4111442
148	Nut, kep, 10-32	HW55002
149	Flowmeter (incl. tube & valve)	4111460
150	Label, ⅝ w/dot and green & white rings	4109373
151	Set Screw, cup point, 10-32 x ⅞ (2x) (used as mtg stud)	HW04011
152	Label, AUXILIARY OXYGEN	4109381



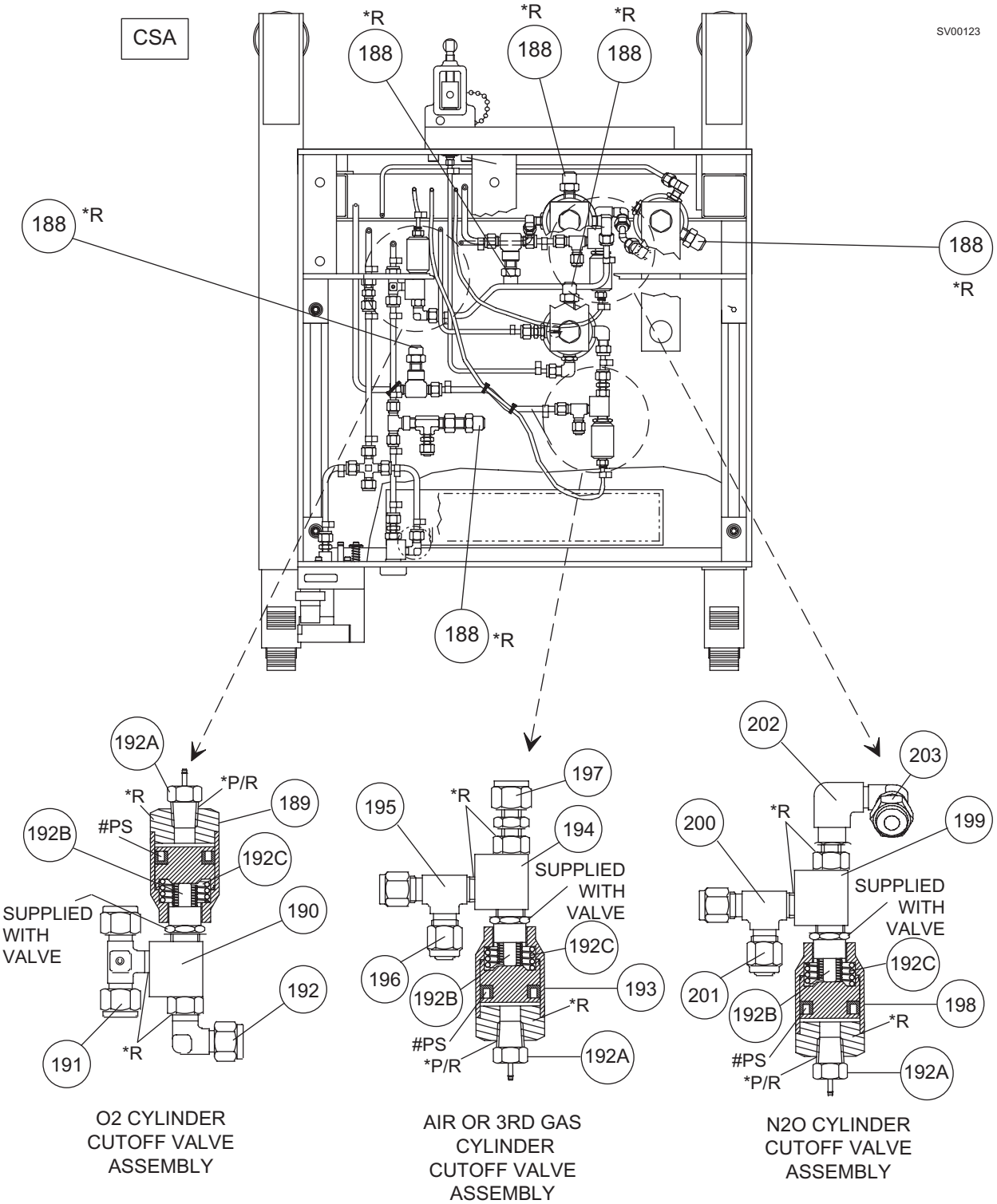
*P = Loctite #222 (Purple)
*R = Loctite #271 (Red)

ITEM	DESCRIPTION	PART NUMBER
	O_2 Regulator Assembly:	
162	Regulator	4103590
163	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
164	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
165	Elbow Fitting, 3/16 Tube x ⅛ MPT (2x)	4109409
166	Elbow Fitting, _ MPT x ⅛ FPT	4103513
167	Tee Fitting, 3/16 Tube x 3/16 Tube x ⅛ MPT [Replaces previous two items if machine has an additional O_2 yoke]	4109404
	N_2O Regulator Assembly:	
168	Regulator	4103591
169	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
170	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
171	Elbow Fitting, 3/16 Tube x ⅛ MPT (2x)	4109409
172	Elbow Fitting, _ MPT x ⅛ FPT	4103513
173	Tee Fitting, 3/16 Tube x 3/16 Tube x ⅛ MPT [Replaces previous two items if machine has an additional N_2O yoke]	4109404
	Air or 3rd Gas Regulator Assembly	
174	Regulator	4103590
175	Elbow Fitting, ¼ Tube x ¼ MPT	4109401
176	Straight Fitting, ¼ MPT x ⅛ FPT (2x)	4102906
177	Elbow Fitting, 3/16 Tube x ⅛ MPT	4109409
178	Straight Fitting, 3/16 Tube x ⅛ MPT	4109415
	O_2 Flush Valve and Related Parts:	
179	Valve, Clippard, 2 way.	4103340
180	Straight Fitting, ¼ Tube x ⅛ MPT	4109408
181	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
182	Restrictor	4101867
183	Spacer	4110792-006
184	Button, O_2 FLUSH	4103249
185	Label, ⅝ Dot, O_2,Green (USA)	4103178
	White (UK, Canada)	4105981
	Blue (Germany)	4111266-002
186	Set Screw, 3-48 x 3/16 (2x)	HW04020
187	Washer	4110792-021

Domestic Freshgas Outlet



ITEM	DESCRIPTION	PART NUMBER
1	Fresh Gas outlet assembly, blue/black	4108673
	Fresh Gas outlet assembly, euro	4108673-001
2	Bushing, common outlet (2x)	4108658
3	Label, “Freshgas Outlet”	4108666-001
4	Shaft, 1/4 x 10-32 (M) x 2.88 (2X)	4108657
5	Spring	4110975-002
6	Plate, locking	4108660-001
7	E-clip	4103512
8	Spacer-R, unthreaded x 0.042	4110792-036


CSA
SV00123
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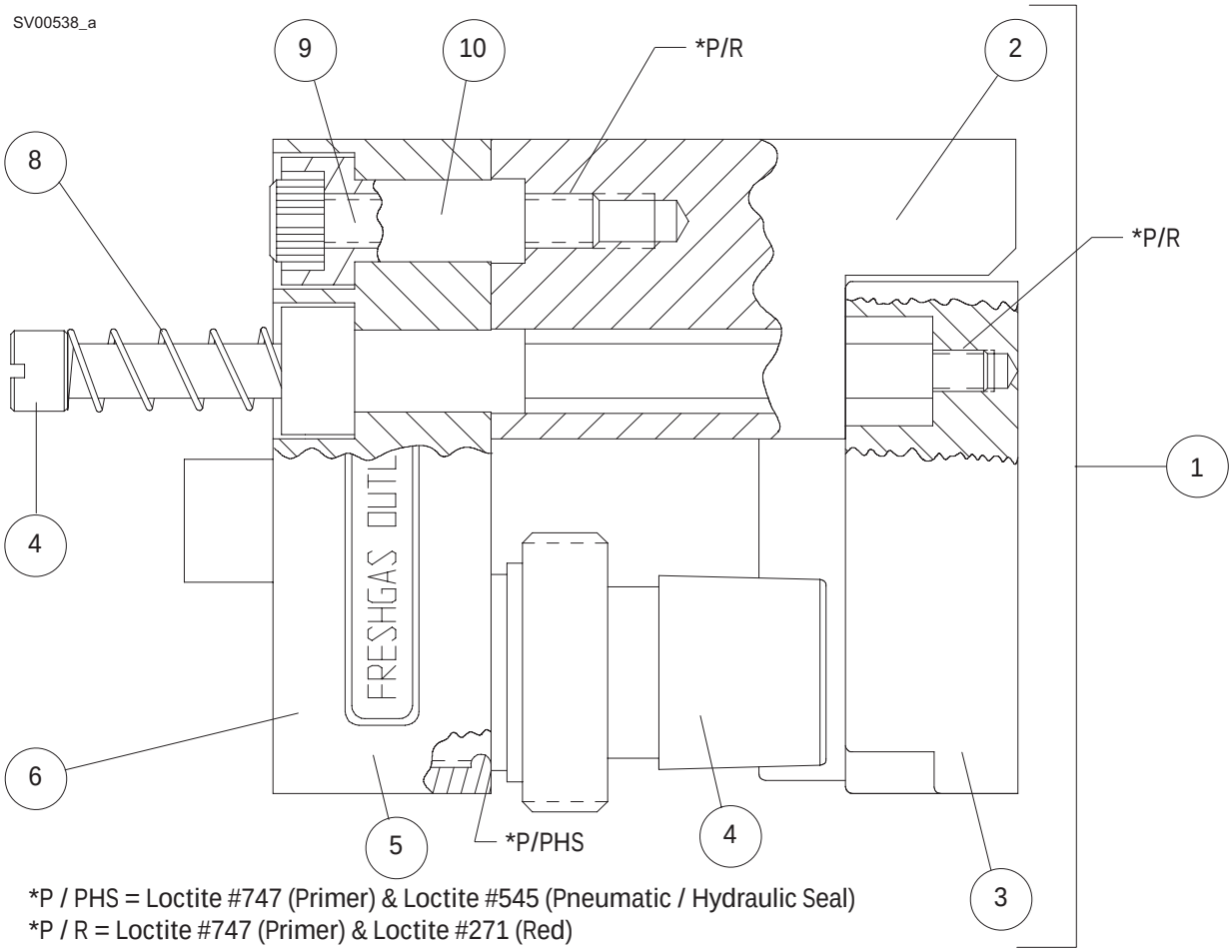
188
O2 CYLINDER CUTOFF VALVE ASSEMBLY
AIR OR 3RD GAS CYLINDER CUTOFF VALVE ASSEMBLY
N2O CYLINDER CUTOFF VALVE ASSEMBLY
SUPPLIED WITH VALVE
#PS
*P/R

ITEM	DESCRIPTION	PART NUMBER
	CSA Items:	
188	Relief Valve, 70 psi (Canada)	4110364
	O_2 Cylinder Cutoff Valve Assembly (Canada)	
189	Pilot Actuator, Modified	4106498
190	Clippard Valve, MJVO-2	4106218
191	Tee Fitting, ¼ Tube x ¼ Tube x ⅛ MPT	4109406
192	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
192A	Straight Fitting, .075 ID Hode x 1/8 MPT	4111771
192B	Spring, .036 OD x .813 L	4110975-009
192C	Spring, .72 OD x 1/8 L	4110975-008
	Air or 3rd Gas Cylinder Cutoff Valve Assembly (Canada)	
193	Pilot Actuator, Modified	4106498
194	Clippard Valve, MJVO-2	4106218
195	Tee Fitting, ¼ Tube x ⅛ MPT x ¼ Tube	4109407
196	Plug, ¼ Tube	4103072
197	Straight Fitting, ¼ Tube x ⅛ MPT	4109408
192A	Straight Fitting, .075 ID Hode x 1/8 MPT	4111771
192B	Spring, .036 OD x .813 L	4110975-009
192C	Spring, .72 OD x 1/8 L	4110975-008
	N_2O Cylinder Cutoff Valve Assembly (Canada)	
198	Pilot Actuator, Modified	4106498
199	Clippard Valve, MJVO-2	4106218
200	Tee Fitting, ¼ Tube x ⅛ MPT x ¼ Tube	4109407
201	Plug, ¼ Tube	4103072
202	Elbow Fitting, ⅛ MPT x ⅛ FPT	4103513
203	Elbow Fitting, ¼ Tube x ⅛ MPT	4109410
192A	Straight Fitting, .075 ID Hode x 1/8 MPT	4111771
192B	Spring, .036 OD x .813 L	4110975-009
192C	Spring, .72 OD x 1/8 L	4110975-008

CSA Freshgas Outlet

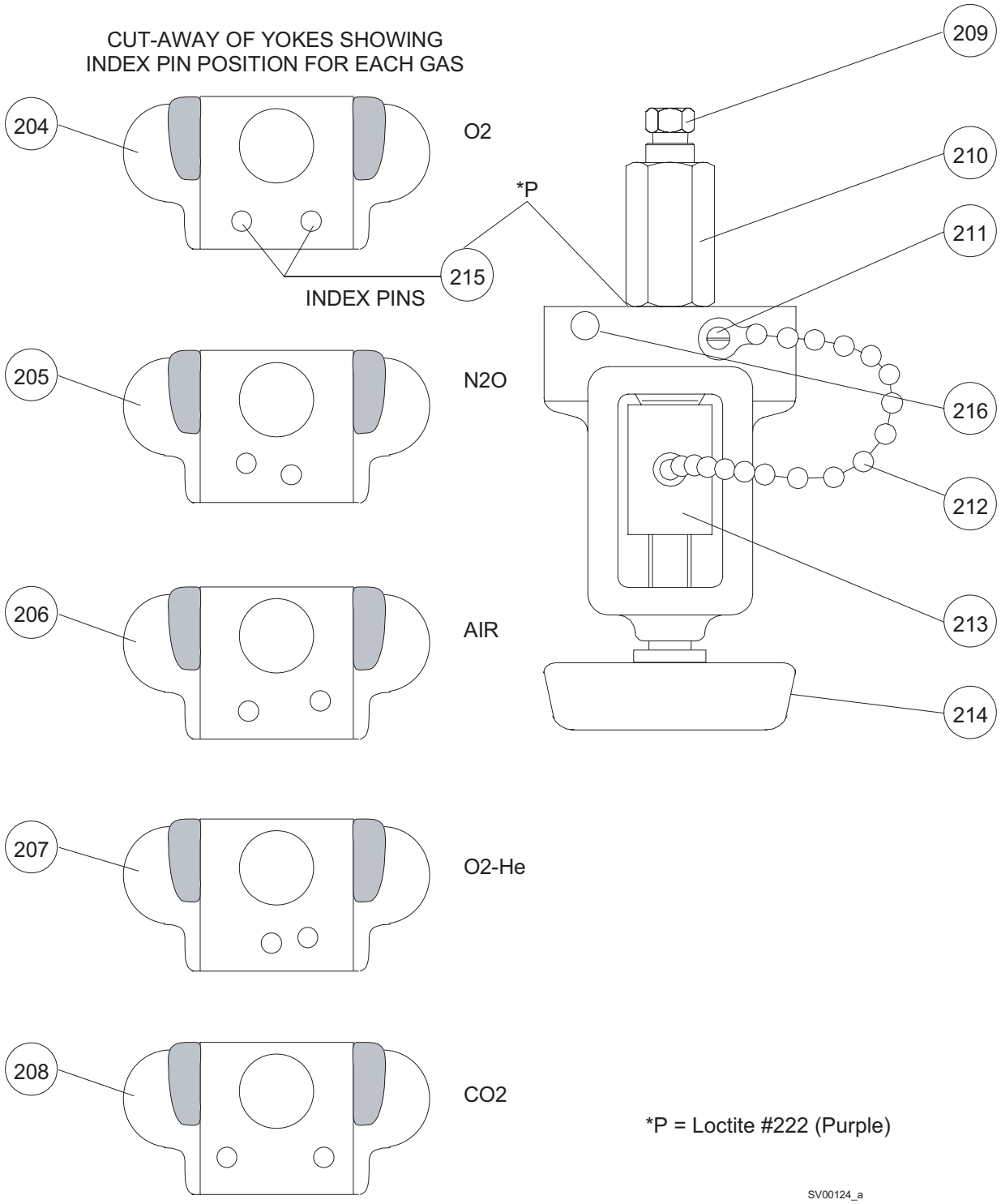


*P / PHS = Loctite #747 (Primer) & Loctite #545 (Pneumatic / Hydraulic Seal)
*P / R = Loctite #747 (Primer) & Loctite #271 (Red)

ITEM	DESCRIPTION	PART NUMBER

CSA Items:

1	Fresh Gas outlet assembly (Canada.UK), blue/black	4109015
	Fresh Gas outlet assembly (Canada/UK), euro	4109015-001
2	Block, guide	4110707
3	Plate, locking	4110708-001
4	Common outlet, 15mm x 22mm	4109013
5	Block, solder asm	4108662-001
6	Label, “Freshgas Outlet”	4108666-001
7	Screw, 1/4 OD x 1/4-28 x 4.6 L sltd	4109011
8	Spring, CPRSN, 0.36 OD x 1 3/8 L	4110975-002
9	Screw, 1/4-20 x 1 1/4 L, cap skt hd	HW01039
10	Bushing	4108658


CUT-AWAY OF YOKES SHOWING
INDEX PIN POSITION FOR EACH GAS
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O2
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INDEX PINS
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N2O
206
AIR
207
O2-He
208
CO2
209
210
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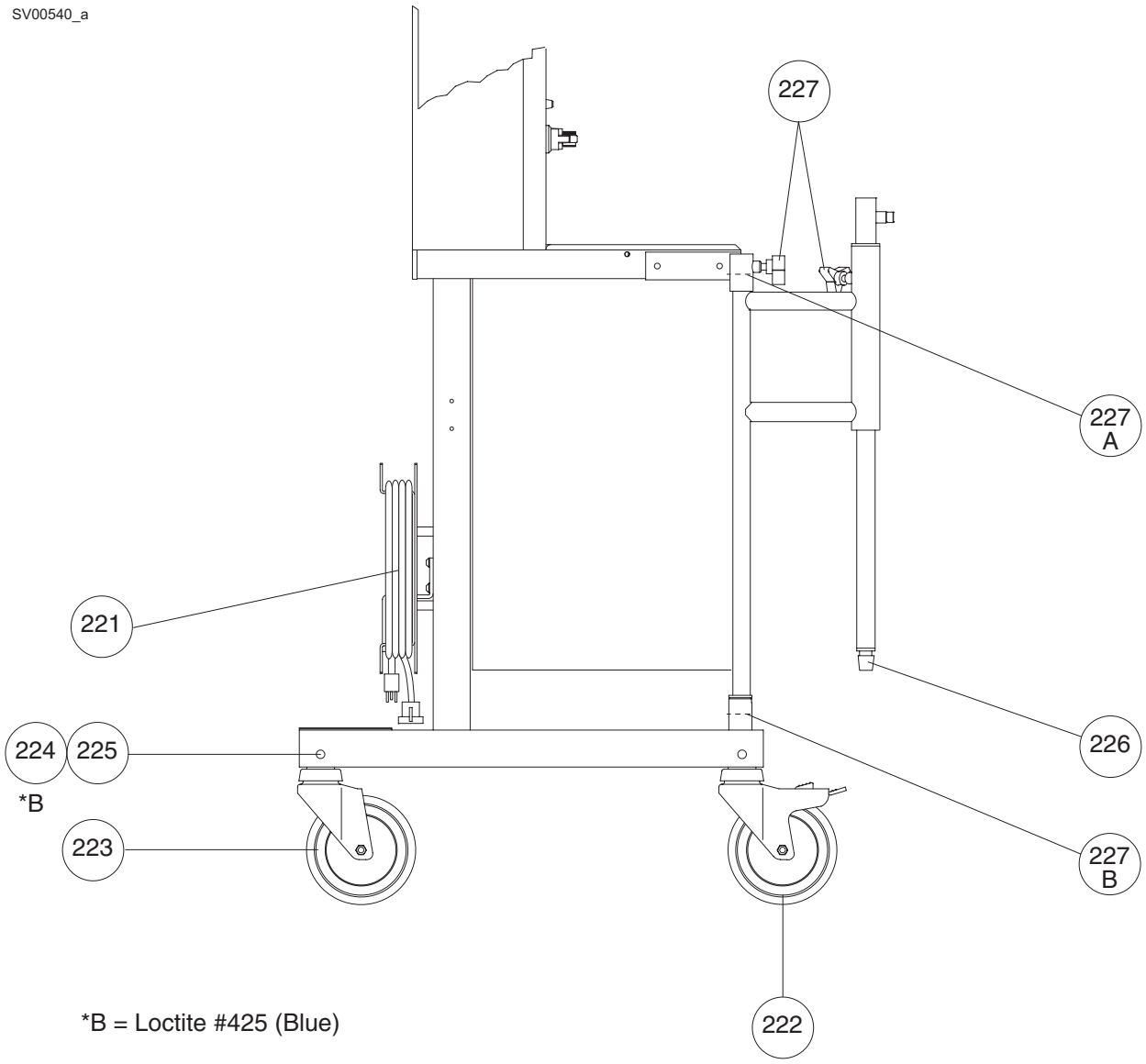
*P = Loctite #222 (Purple)
SV00124_a

ITEM	DESCRIPTION	PART NUMBER
204	Yoke, O_2	1101620
205	Yoke, N_2O	1101621
206	Yoke, Air	1101625
207	Yoke, O_2-He	4110957
208	Yoke, CO_2	1101624
	Parts Common to All Yokes:	
209	Nut, 3/16 Tube	4104716
	Nut, 3/16 Tube	4109489
	3/16 Ferrule	4111038
210	Check Valve Assembly	4111792
	Check Valve Assembly	4118190
211	Screw, 10-32 x ⅜ in. rd hd	HW06006
212	Chain Assembly	4112495-003
213	Plug	1101655
	Plug assembly includes Items 212, 213	4112755-001
214	Plastic T-handle & bolt	4113536
215	Screw (Index Pin) (2x per yoke)	4105929
216	Yoke Labels:	
	Label, O_2,Green (USA)	1101768
	White (UK)	4103890
	Blue (Germany)	4111266-001
	Label, N_2O,Blue (USA, UK, Canada)	1101619
	Gray (Germany)	4111266-003
	Label, Air,Yellow (USA, Germany)	4102742
	Black/White (UK)	4103826
	Label, O_2-He, Green/Brown (USA)	4110950
	White/Brown (Canada)	4110942
	Label, CO_2, Gray (USA, UK)	1101639
	Black (Germany)	4111266-005


SV00540_a
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A
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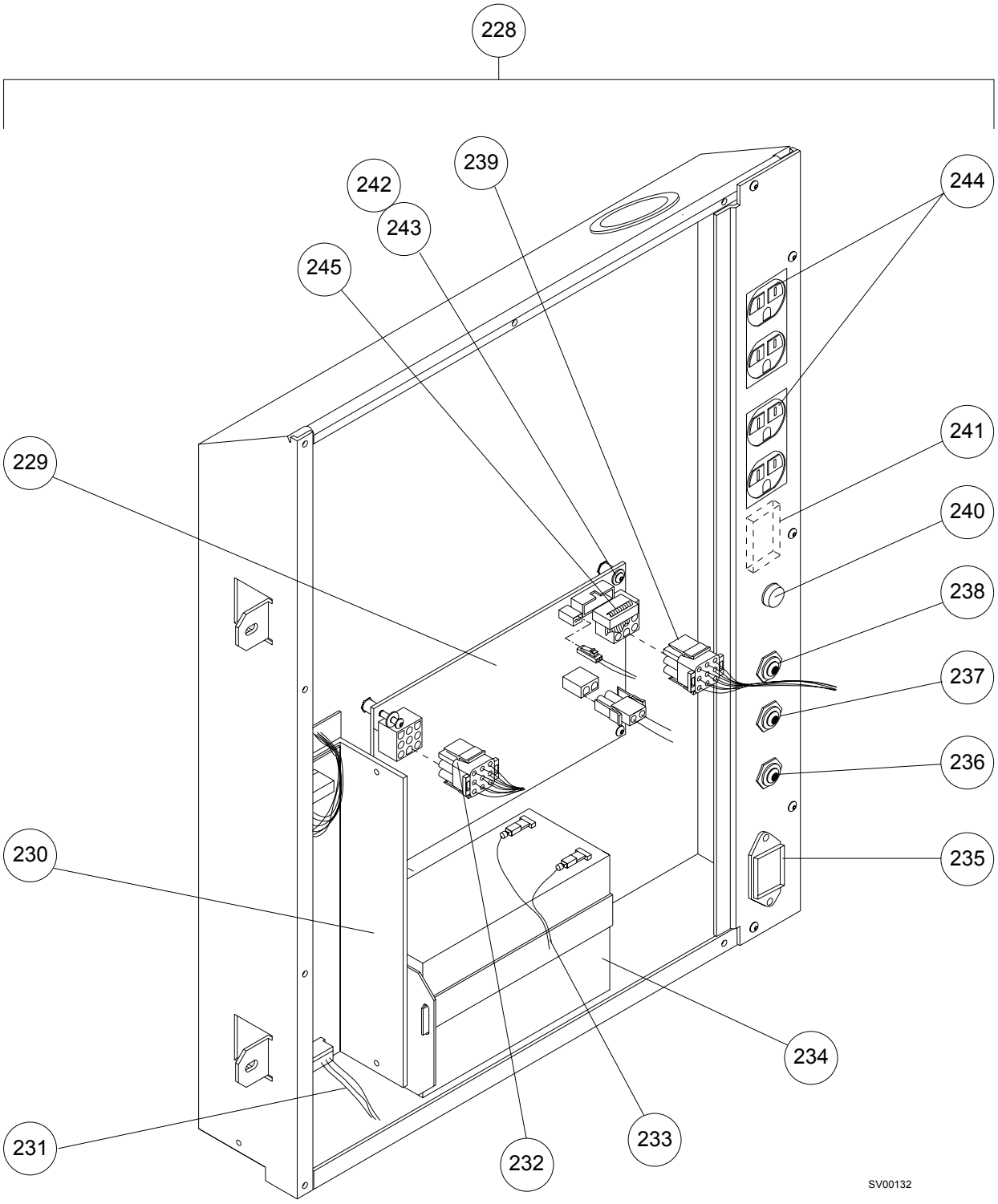
*B = Loctite #425 (Blue)

ITEM	DESCRIPTION	PART NUMBER
221	AC Power Cord Assembly	4109600
	AC Power Cord Assembly (Export)	4110625
222	Caster, 6 in. W/Brake (2x)	4111849
	Caster, 5 in. W/Brake (2x) (early machines)	4113006-004
223	Caster, 6 in. W/O Brake (2x)	4111850
	Caster, 5 in. W/O Brake (2x) (early machine)	4113006-003
224	Setscrew, Caster (4x)	HW04017
225	Hole Plug, (4x)	4102729
226	Absorber Pole	1101724
	Later design without hose connections	4114650
227	Wing Screw, ⅜-16 x 1 in.	1100078
227A	Roll pin, 0.250 dia x 1 in.	HW75005
227B	Roll pin, 0.125 dia x 3/8 in.	HW75004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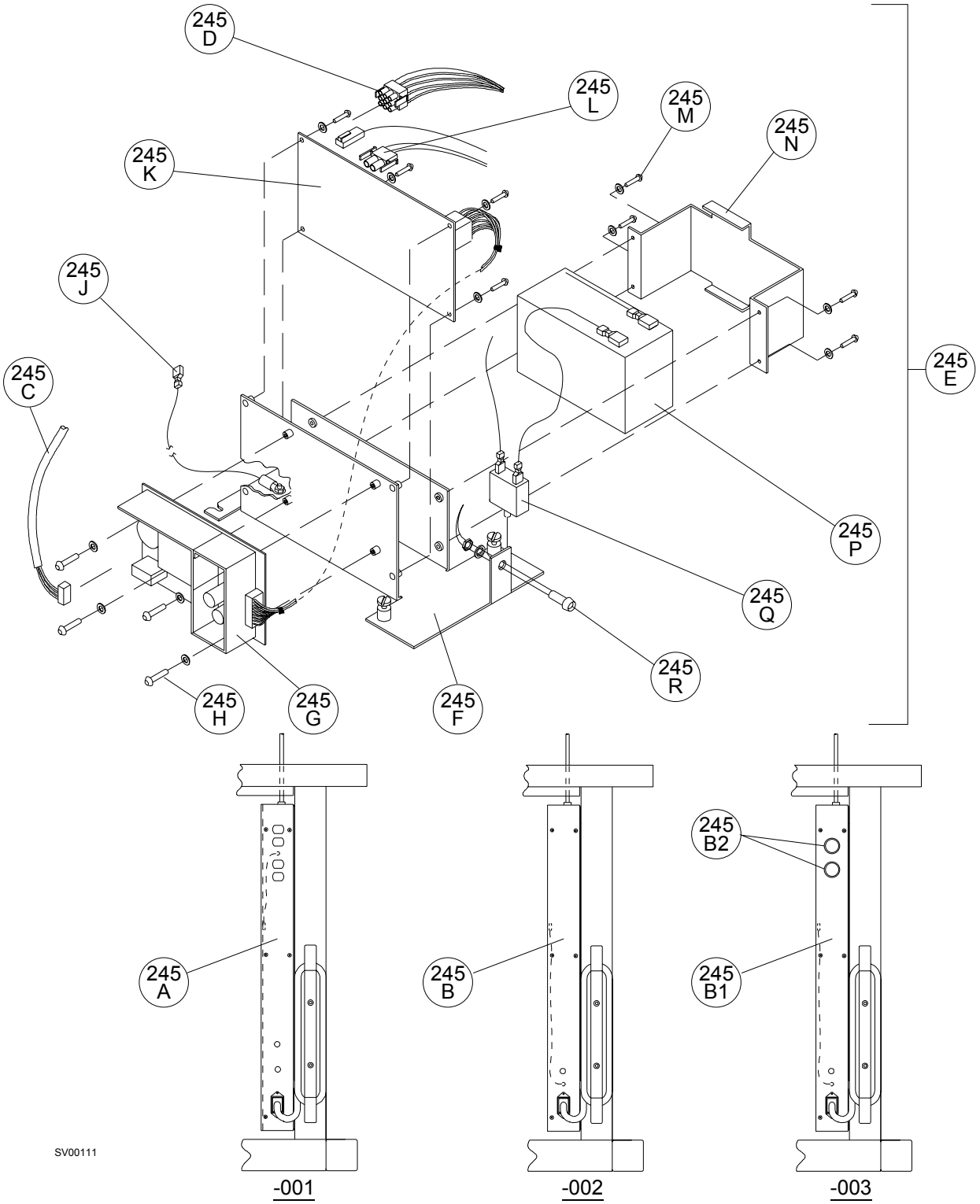
ITEM	DESCRIPTION	PART NUMBER
228	Power Supply Assembly, 110V	4113820-001
	Power Supply Assembly, 220V	4113820-002
229	Power Supply PCB Assembly	SE4113579, 4113579
230	Primary Power Supply	SE4113646, 4113646
231	Power Supply Input Wire Harness	4113767
	Pwr. Supply Mounting Hardware:	
	Screw, 6-32 x ¼ in. btn hd (4x)	HW09004
	Lock Washer, #6 int-t (4x)	HW67015
	Kep Nut, 8-32	HW55001
232	Wire Harness, Primary Power Supply to PCB Assembly	4113764-001
233	Battery Wire Harness	4113761-001
234	Battery, 12V	4106093
	Battery Bag	4110255
235	Power Entry, Outside Mount	4109577
	Mains Filter	4112003
236	Circuit Breaker, Mains	4110537-002
237	Circuit Breaker, Battery	4110923-005
238	Circuit Breaker, Convenience Outlets (not on 220V version)	4110537-008
239	Output Wire Harness (to J14 on Processor)	4113759
240	Lamp Assembly	4113833
241	Filter, Convenience Outlets (not on 220V version)	4112450
242	Screw, 6-32 x ⅜ in. btn hd (4x)	HW09000
243	Lock Washer, #6 int-t (4x)	HW67015
244	Duplex Outlet (2x) (not on 220V version)	4112574-001
245	Cable Asm, 14-cond. ribbon (to J4 on Alarm Channel)	4112149-001

power supply located in display box (early design)

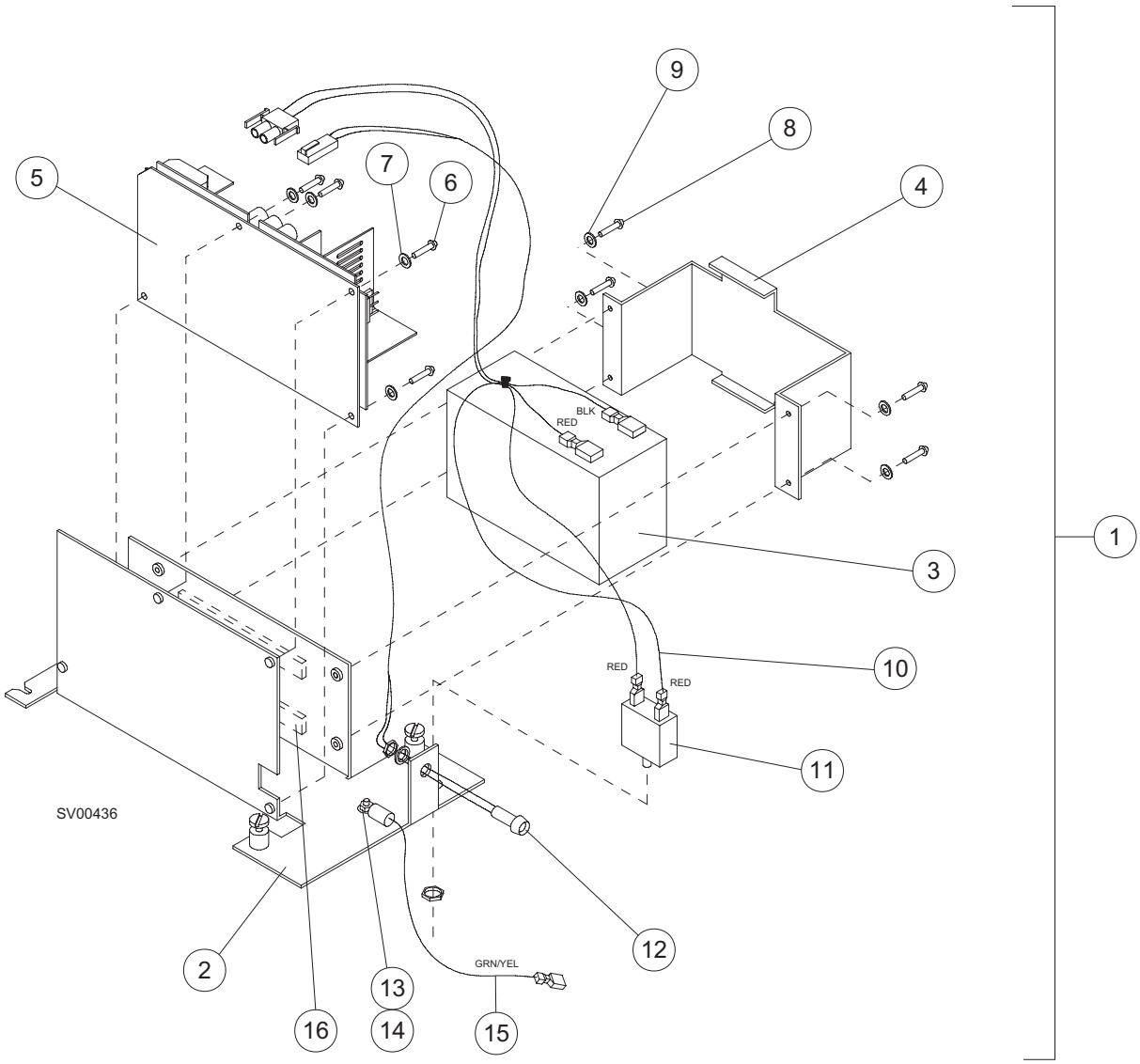


ITEM	DESCRIPTION	PART NUMBER
245A	Receptacle Cover Assembly, Domestic * (duplex outlets)	4114827-001
245B	Receptacle Cover Assembly, Export (no outlets)	4114827-002
245B1	Receptacle Cover Assembly, Export (CEE7 outlets)	4114827-003
245B2	Receptacle, CEE7 (2x)	4114986
245C	Power Supply Input Cable	4114518
245D	Cable Assembly (power supply to processor & lamp)	4114519
245E	Power Supply Assembly**	
245F	Base Plate	4114508
245G	Power Supply	4114523
	Power Supply, Service Exchange	SE4114523
245H	Screw, 6-32 x 7/16 in. btn hd skt (8x)	HW09017
	Lock Washer, #6 split (8x)	HW65001
245J	Ground Wire Assembly	4112301-026
245K	Power Supply PCB Assembly	4113579
	Power Supply PCB Assembly, Service Exchange	SE4113579
245L	Battery Wire Harness	4113761-001
245M	Screw, 8-32 x 3/8 in. cap skt hd (4x)	HW01012
	Lock Washer, #8 split (4x)	HW65011
245N	Battery Retainer Bracket	4114515
245P	Battery, 12 V	4106093
	Battery Bag	4110255
245Q	Circuit Breaker, Battery	4110923-005
245R	Lamp Assembly, incl. connector	4113833

* Receptacles, Circuit Breakers, Mains Filter, and Power Entry Module have same part numbers as their corresponding parts in an earlier design arrangement listed on a previous page.

**See next two pages for later design power supply.

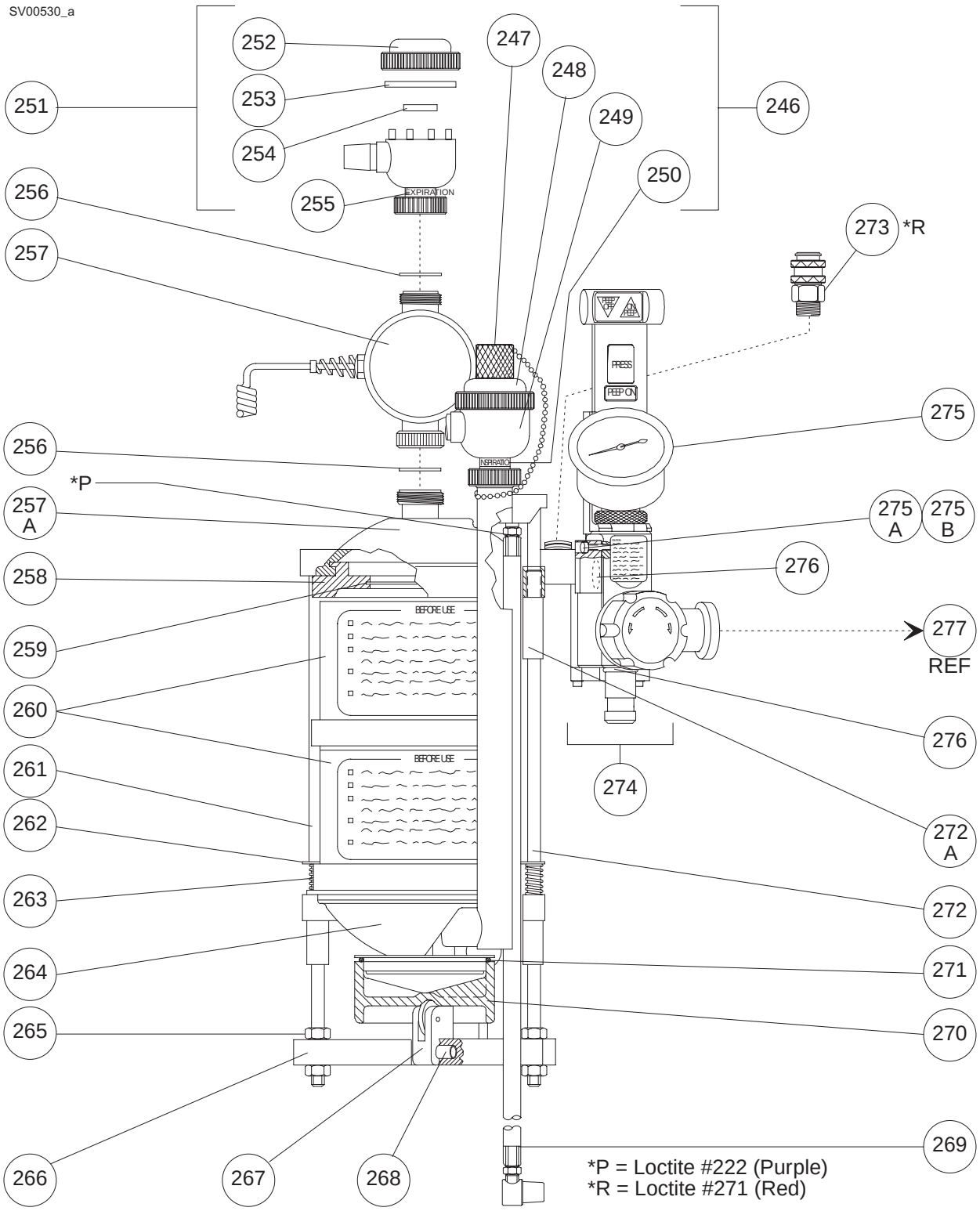
power supply located in display box (later design)



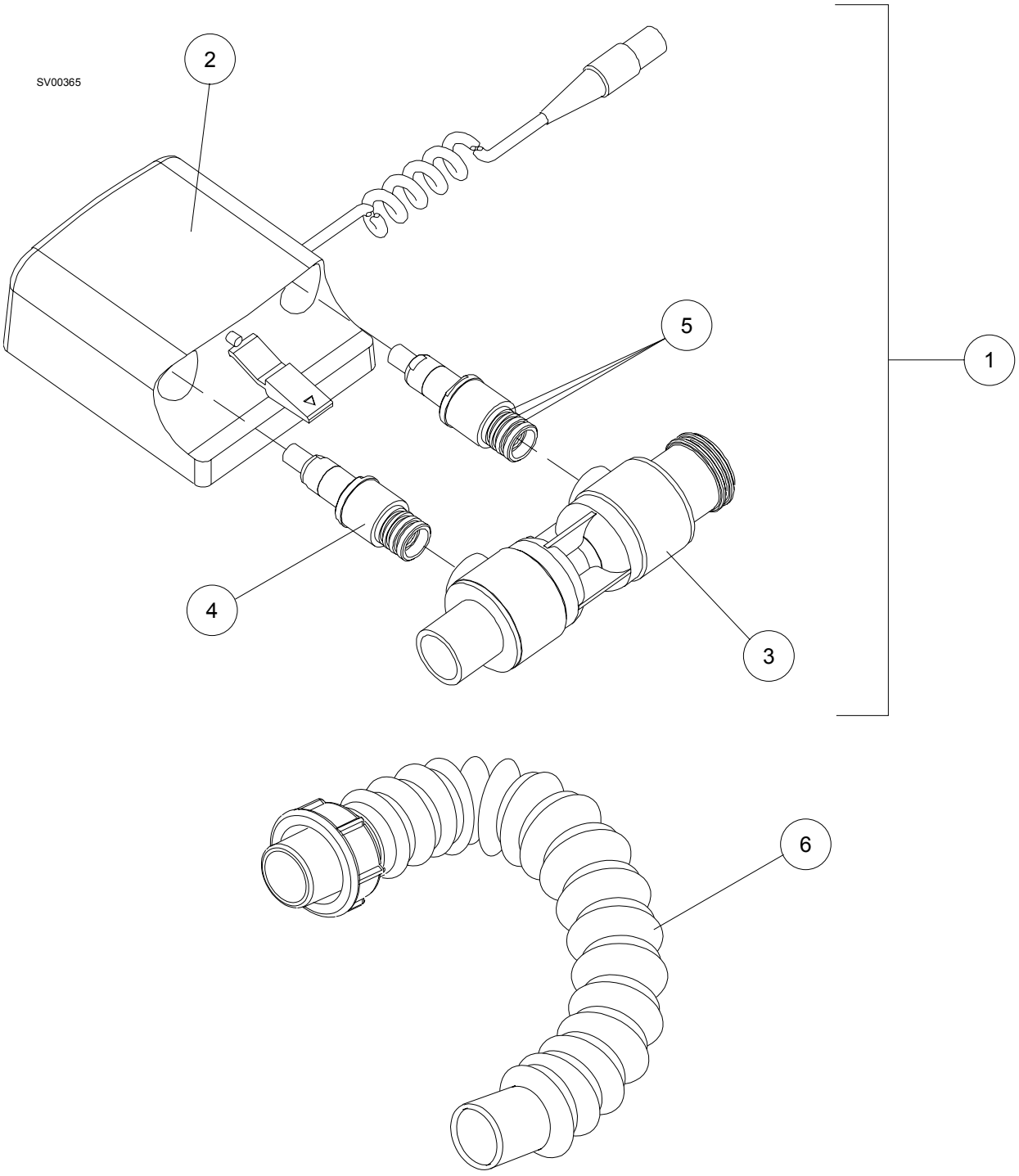
ITEM	DESCRIPTION	PART NUMBER
1	Power Supply Assembly	
2	Bracket	4115593
3	Battery, 12 V	4106093
	Battery Bag	4110255
4	Battery bracket	4114515
5	Power Supply, Condor	4115264
6	Screw, 6-32 x 5/16 in. btn hd skt (4x)	HW09022
7	Lock Washer, #6 split (4x)	HW65001
8	Screw, 8-32 x 3/8 in. cap skt hd (4x)	HW01012
9	Lock Washer, #8 split (4x)	HW65011
10	Battery Wire Harness	4113761-001
11	Circuit Breaker, Battery	4110923-005
12	Lamp assembly, 18 V	4115617
13	Kep nut, 6-32	HW55003
14	Lock washer, #6 ext-t	HW68000
15	Ground wire assembly	4112301-033
16	Foam cushion (2x)	4109748

Receptacles, Circuit Breakers, Mains Filter, and Power Entry Module have same part numbers as their corresponding parts in an earlier design arrangement listed on a previous page.

SPARE AND REPLACEMENT PARTS (continued) NMGS



ITEM	DESCRIPTION	PART NUMBER
	Absorber Assembly	4109430
	Absorber Assembly with PEEP and bypass valve	4109431
246	Inspiratory Valve Assembly w/O_2 sensor mount (new number)	4112773-001
247	Plug Assembly, Oxygen Sensor	4106387
248	Dome & Label, Insp. Valve	4108329
249	Valve Asm	4112151, SE4112151
250	Label, Inspiration	1100559
251	Expiratory Valve Assembly	4112150, SE4112150
252	Dome	2109230
253	Gasket, Valve Dome (Both Valves)	2109231
254	Disk (Both Valves)	M23225
255	Label, Expiration	1100565
256	Gasket, Valve Mount	1101690
257	Spiromed Sensor	4106362, SE4106362
257A	Dome Assembly, absorber, chrome	1101351
258	Gasket, Canister Top	4105848
259	Screen, Canister	1100022
260	Canister Assembly (2x)	4105851
261	Rod, Left	1101356
262	Clip, E-Ring (2x)	1100097
263	Spring (2x)	4110975-010
264	Bottom Sub-Assembly	4112932
	Gasket, absorber bottom (not shown)	1101001
265	Nut, ⅜-16 SS (4x)	HW50010
266	Cam Bar (2x)	1101018
267	Cam Assembly	1101015
268	Dowel Pin	1101017
269	Hose Assembly, Fresh Gas	4108577
270	Dust Cap	4106874
271	O-Ring	4102940
272	Rod, Right	1101355
272A	Bushing	1101023
273	Quick Disconnect Fitting (Breathing Pressure)	4108139
274	PEEP Bypass and Valve Assembly	4111527, SE4111527
	Magnet assembly	4114419
	O-ring, #126 (neoprene)	4111878
	Knob	4113558
275	Gauge Assembly, Breathing Pressure (Incl Mtg Ring and O-Ring)	4115275
	Guage, -20/80 cmH2O	4115273
	Replacement Cover	4113387
	Replacement Ring	4113388
275A	Screw, 8-32 x 1/2 in.	HW01014
275B	Lock Washer, #8 split	HW65001
276	O-Ring, #117, Silicone (2x)	4105766
	Breathing press hose asm (quick disc. ftg on each end)	4109368
	Breathing press hose asm (quick disc. ftg one end, Luer fitting other end)	4108528
	O_2 Sensor: Complete Assembly, including capsule	4110374
	Sensor Capsule	6850645
	Housing Assembly	4106363
	Adapter (cover)	4106385
	O-ring, #025 (viton)	4105791
	O-ring, #016 (viton) (2x)	4106388


SV00365
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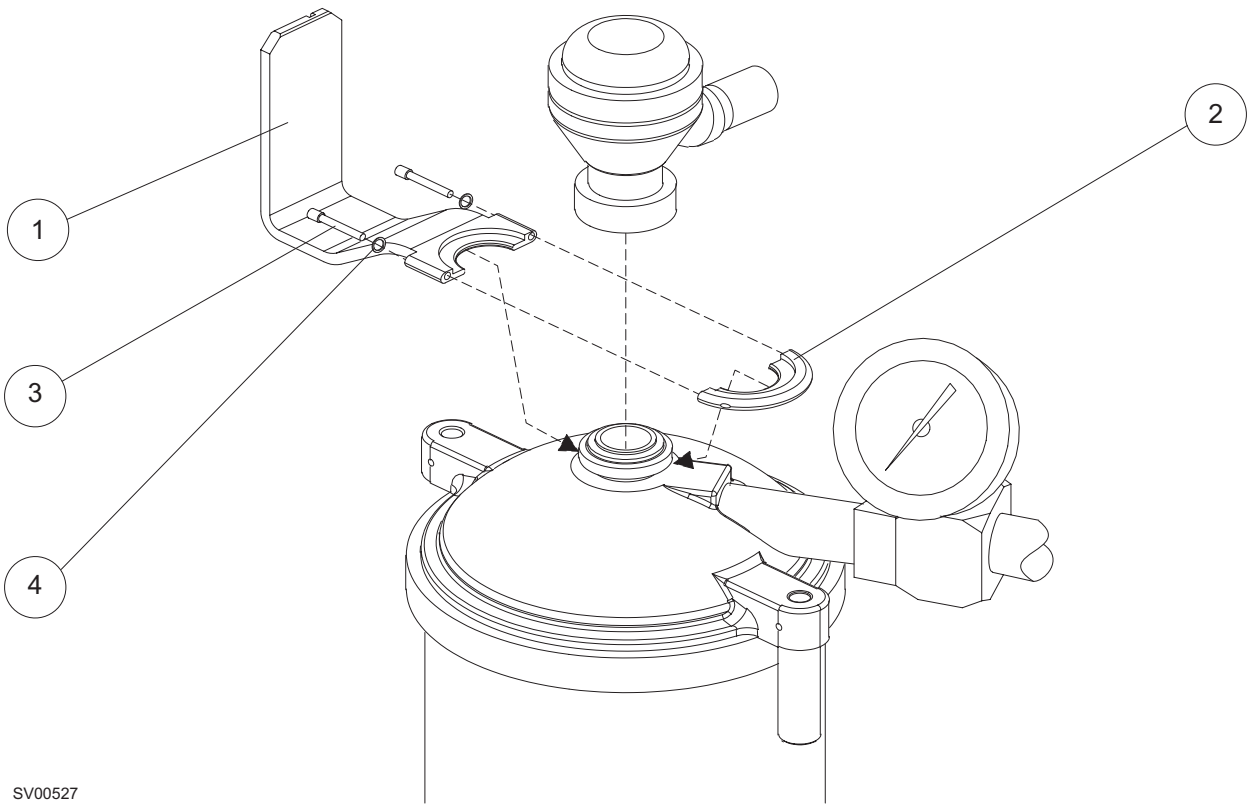
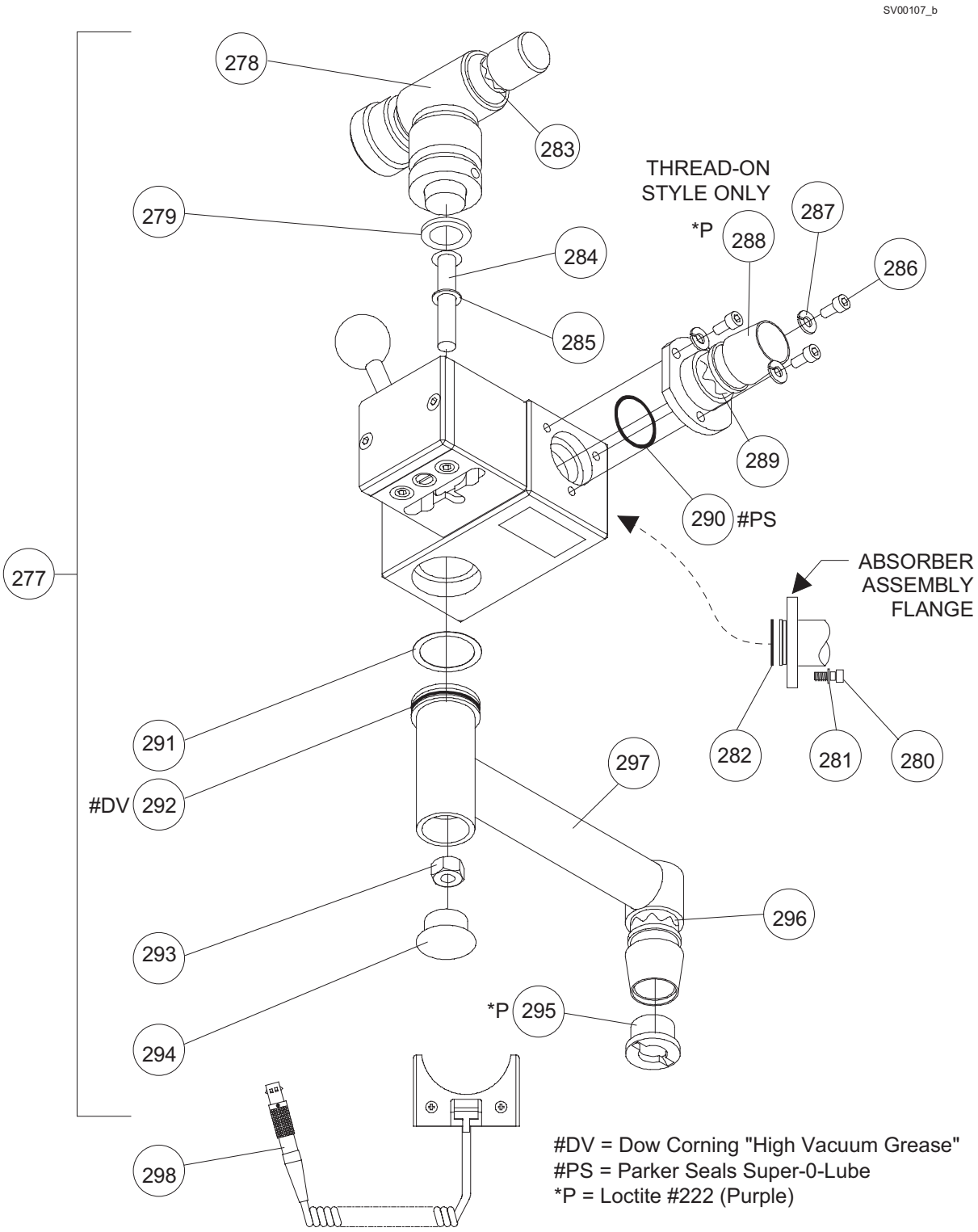
ITEM	DESCRIPTION	PART NUMBER
1	Ultrasonic Flow Sensor Assembly	4115754-001
	Service Exchange part number	SE4115754-001
2	Electronics Housing (ref. only, not a spare part)	
3	Flow Housing	4114444
4	Transducer - set of two, incl. O-rings	4114445
5	O-ring, set of six	4115147
6	Connector Hose	4114912

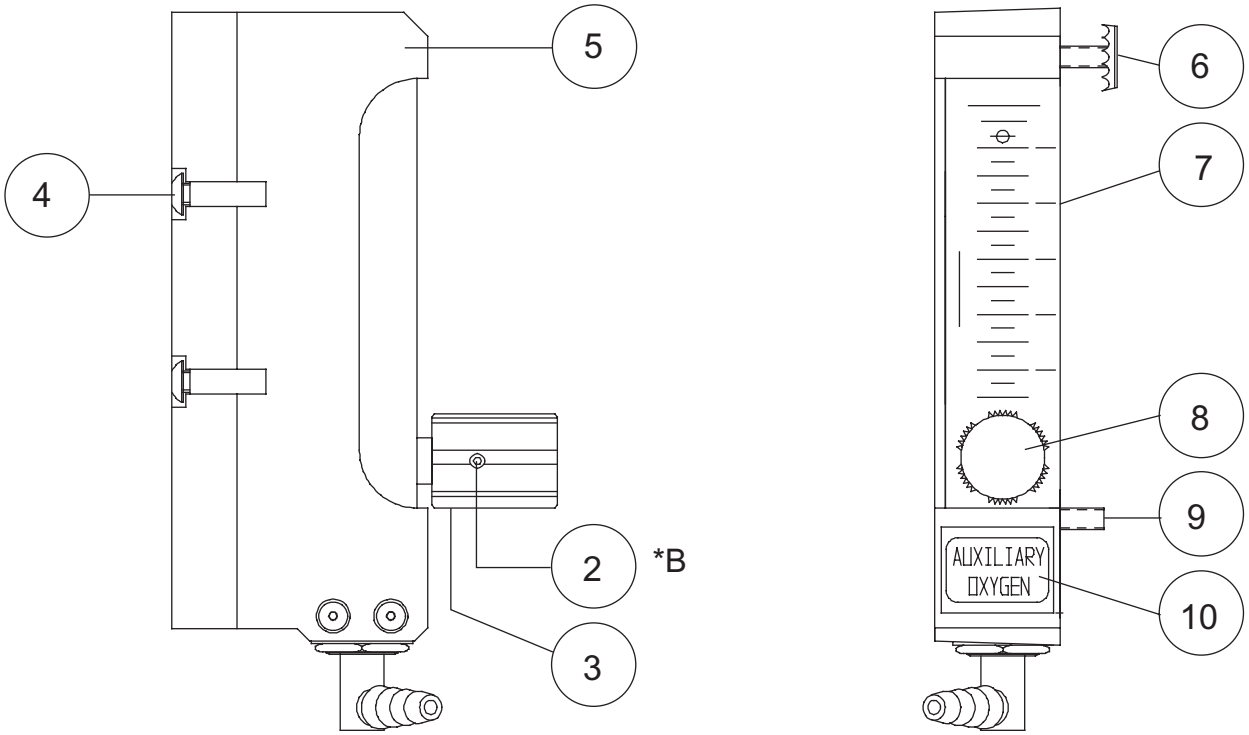

1
2
3
4
SV00527

ITEM	DESCRIPTION	PART NUMBER
1	Bracket, Flow Sensor Mounting	4114889
2	Clamp, Flow Sensor Mounting	4114888
3	Screw, 4-40 x 1.1 L cap skt hd (2x)	HW01103
4	Lock Washer, #4 split (2x)	HW65000


SV00107_b
278
283
279
284
285
THREAD-ON
STYLE ONLY
*P
288
287
286
289
290
#PS
277
ABSORBER
ASSEMBLY
FLANGE
291
#DV
292
297
282
281
280
296
293
*P
295
294
298
#DV = Dow Corning "High Vacuum Grease"
#PS = Parker Seals Super-0-Lube
*P = Loctite #222 (Purple)

ITEM	DESCRIPTION	PART NUMBER
277	Valve, Man/Auto Selector	4112217-001
	Valve, Man/Auto Selector, Service Exchange	SE4112217-001
278	APL Valve	4104839
279	Fiber Washer	(Supplied with APL Valve)
280	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
281	Lock Washer, Selector Valve Mounting, #8 int-t (3x)	HW67000
282	O-Ring, #117 (silicone)	4105766
283	Label, "Scavenger Hose"	4104806
284	Screw, 5/16-18 x 3¾ in. Rd Hd	HW06023
285	Spacer	4110792-070
286	Screw, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
287	Lock Washer, #8 split (3x)	HW65011
288	Connector Assembly, 22mm (Bolt-on Style)	4106744
	Connector - 22mm w/ Spanner	4112918
289	Label, "Ventilator Hose"	1100563
290	O-Ring, #117 Silicone	4105766
291	Spacer	4110792-071
292	O-Ring, #120 EPDM	4112629-001
293	Nut, 5/16-18 Hexseal	4112613-001
294	Hole Plug, 3/16 in. dia.	4111663-001
295	Bag Connector	4102894
296	Label, "Breathing Bag"	1100561
297	Bag Mount Assembly	4112622-001
298	Man/Auto Sensor Cord Asm. (for AV-2+ ventilator)	4113126

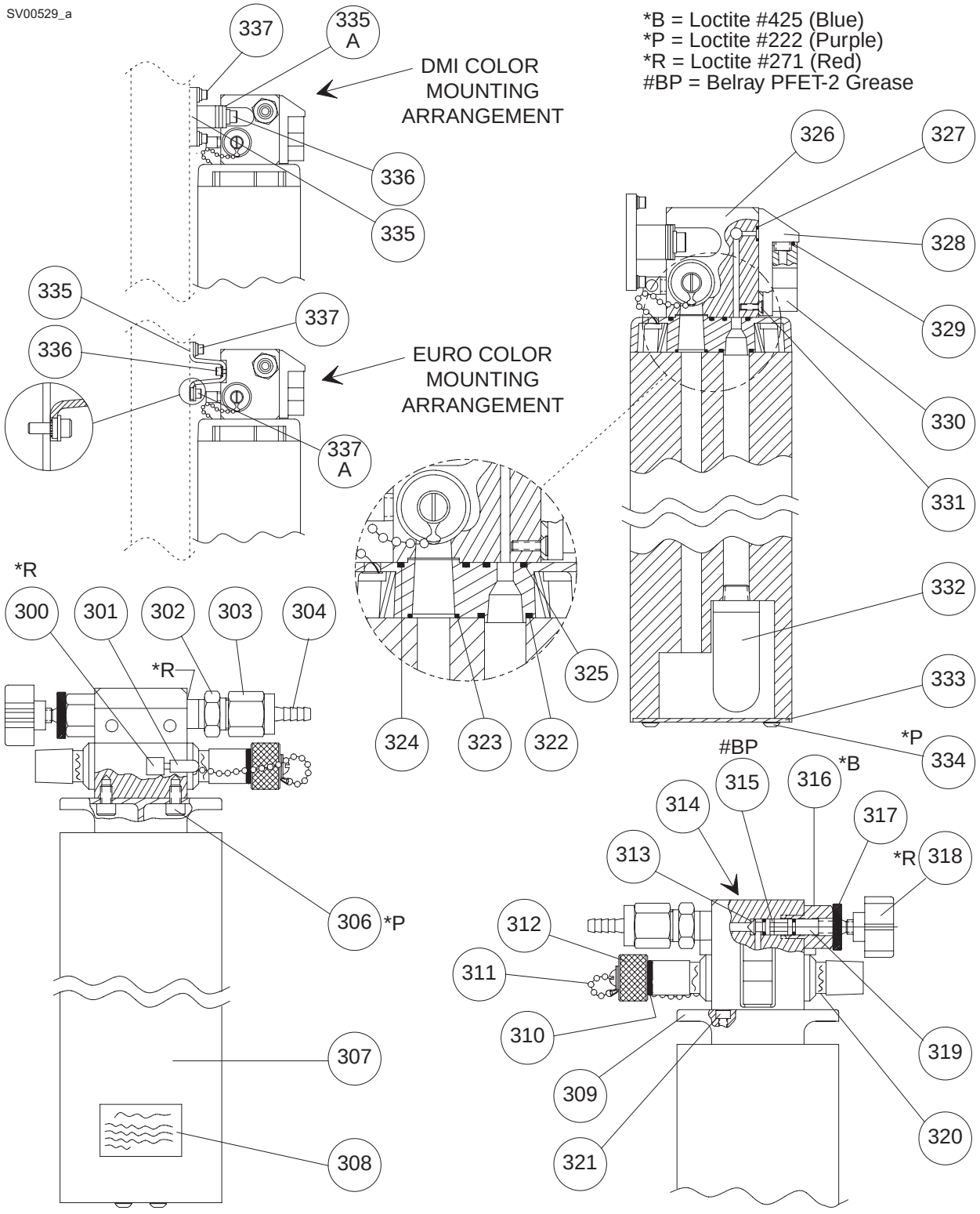
1 AUXILIARY O2 FLOW METER, NEW STYLE



*B = LOCTITE #425 (BLUE)

SV00910

ITEM	DESCRIPTION	PART NUMBER
1.	Auxiliary O_2 Flow Meter Assembly, new style	4109310
2.	Set Screw, cup point, 6-32 x 1/4 in.	HW04003
3.	Knob	4111442
4.	Screw, 10-32 x 1 1/16 in. btn hd (2x)	HW09043
5.	Housing	4111053
6.	Kep nut, 10-32 (2x)	HW55002
7.	Flowmeter (incl. tube & valve)	4111460
8.	Label, 5/8 w/dot and green & white rings	4109373
9.	Set Screw, cup point, 10-32 x 7/8 (2x) (used as mtg stud)	HW04011
10.	Label, AUXILIARY OXYGEN	4109381


SV00529_a
*B = Loctite #425 (Blue)
*P = Loctite #222 (Purple)
*R = Loctite #271 (Red)
#BP = Belray PFET-2 Grease
DMI COLOR MOUNTING ARRANGEMENT
EURO COLOR MOUNTING ARRANGEMENT
337
335 A
336
335
337
337 A
326
327
328
329
330
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332
333
334
325
324
323
322
*R
300
301
302
303
304
306
*P
307
308
#BP
*B
315
316
314
317
313
*R
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321
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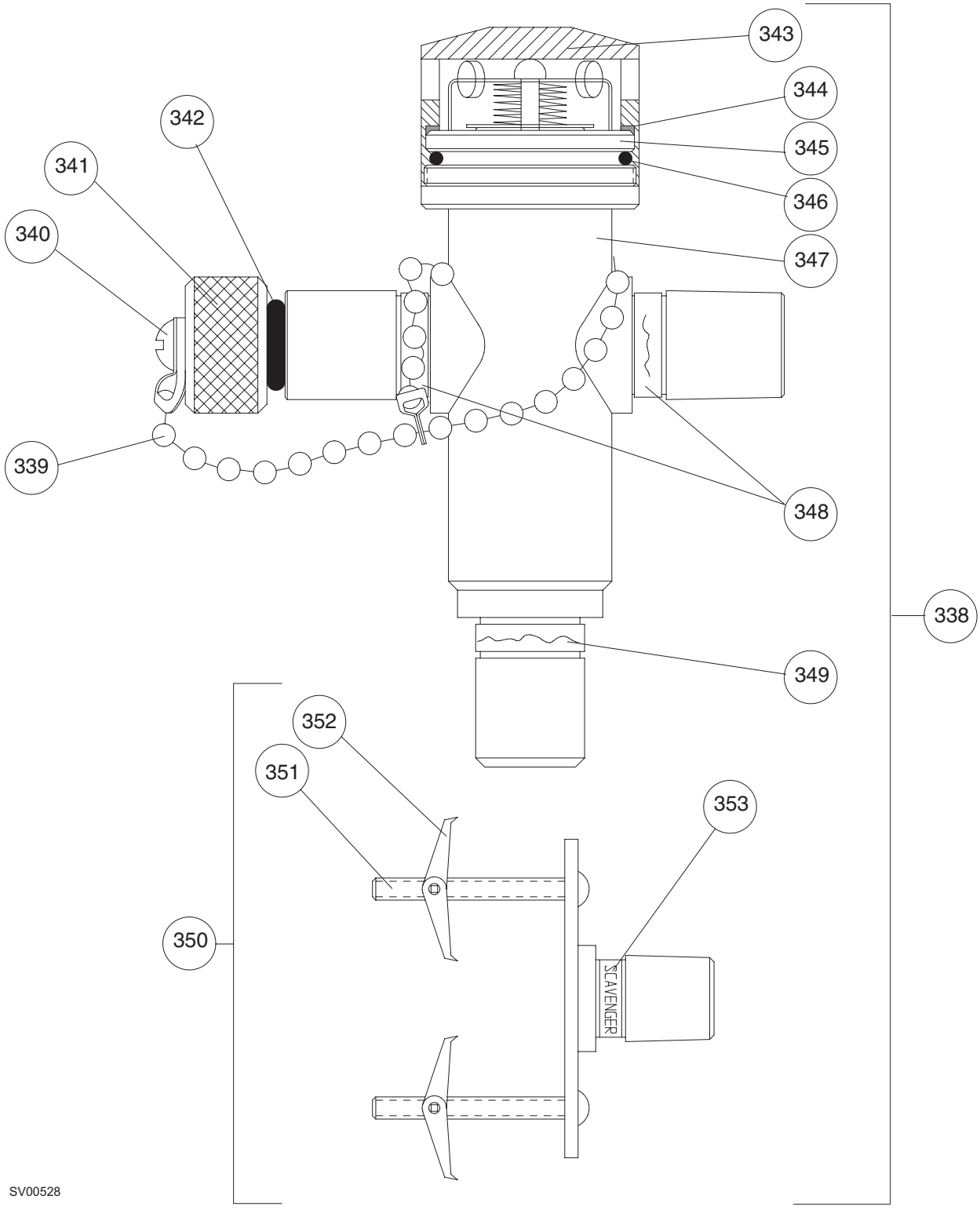
320

ITEM	DESCRIPTION	PART NUMBER
	Open Reservoir Scavenger Assembly	NAD color 4107624; Euro color 4107624-003
300	Elbow, ⅛ M x ¼ in. hose	4106881
301	Cap, Vinyl	4110045
302	Body, DISS VAC x ¼ MPT	4103669
303	Nut, DISS VAC	4103122
304	Hose Barb Nipple	4103123
305	Deleted	
306	Screw, ¼-20 x ⅜ in. skt hd (2x)	HW01033
307	Reservoir	NAD color 4110982; Euro color 4110982-001
308	Label, CAUTION	NAD color 4104294; Euro color 4104294-001
309	Reservoir Top	NAD color 4110979; Euro color 4110979-001
310	O-ring #112 (neoprene)	4102141
311	Chain, 8¼ lg	4112495-005
312	Plug	4102140
313	O-ring #008 (neoprene)	4102022
314	Label, ACTIVATE HOSP VAC	NAD color 4109305; Euro color 4109305-001
315	Retaining Ring	4110997
316	Nut, Valve Stem Retainer	4109316
317	Lock Nut, ⅜-24	4112137
318	Wing Nut	4105699
319	Spindle	4112138
320	Label, SCAVENGER HOSE (2x)	4104806
321	Screw, 10-32 x ¾ in. skt hd (4x)	HW01028
322	O-ring #019 (neoprene)	4106458
323	O-ring #015 (neoprene)	4104602
324	O-ring #019 (neoprene)	4106458
325	O-ring #013 (neoprene)	4102234
326	Block	NAD color 4111002; Euro color 4111002-001
327	O-ring, #008 (neoprene)	4102022
328	Flowmeter Housing	4110980
329	O-ring, #012 (neoprene)	1101523
330	Flowmeter	4112289
331	Screw, 6-32 x ⅜ in. flat hd (2x)	HW05006
332	Silencer	4110999
333	Reservoir Cap	4111000
334	Screw, 10-32 x ⅜ in. btn hd (4x)	HW09005
	NAD Color Mounting Arrangement:	
335	Bracket Assembly	4106231
335A	Mounting Bracket	4109314
336	Screw, ¼-20 x ½ in. skt hd (2x)	HW01034
	Lock Washer, ¼ int-t (2x)	HW67005
337	Mounting Hardware: Screw, 10-32 x ½ in. skt hd (2x)	HW01025
	Lock Washer, #10 split (2x)	HW65003
	Flat Washer, #10 (2x)	HW66003
	Euro Color Mounting Arrangement:	
335	Bracket	4114204
336	Screw, 8-32 x ½ in. skt hd (2x)	HW01014
	Lock Washer, #8 int-t (2x)	HW67000
337	Upper mounting screw hardware: Screw, 10-32 x ½ in. skt hd	HW01025
	Lock Washer, #10 split	HW65003
	Flat Washer, #10	HW66003
337A	Lower mtg screw pre-assembly: Screw, 10-32 x ½ in. skt hd.	HW01025
	Flat Washer, #10	HW66003
	Spacer	4110791-037


343
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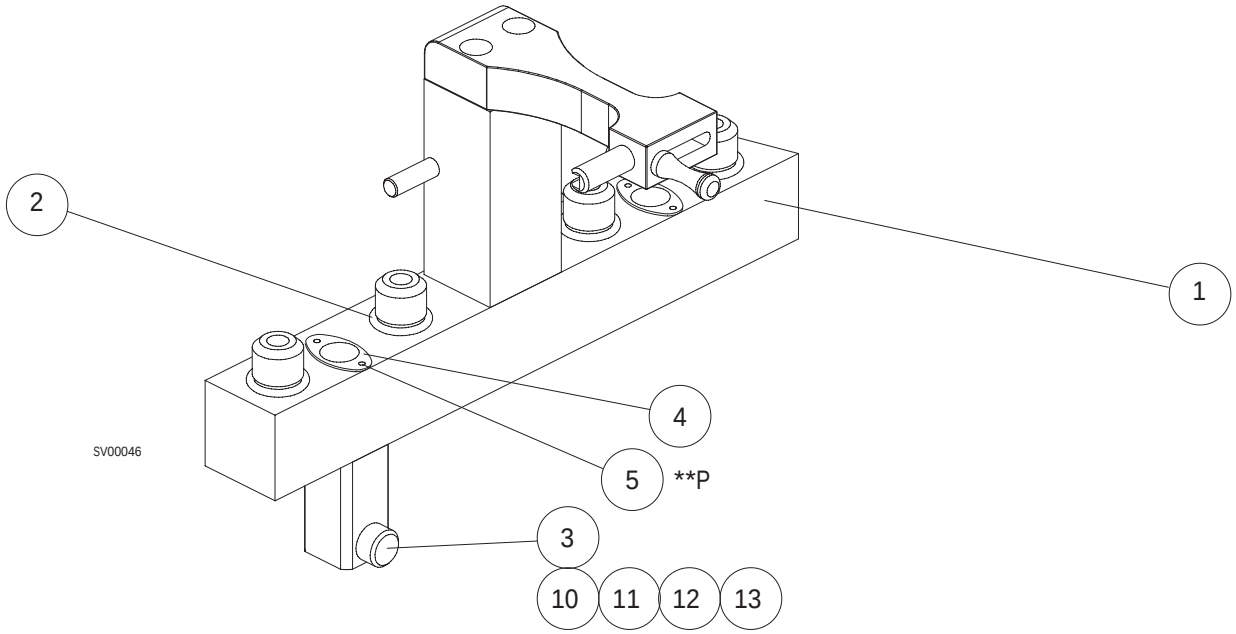
350
SCAVENGER
SV00528

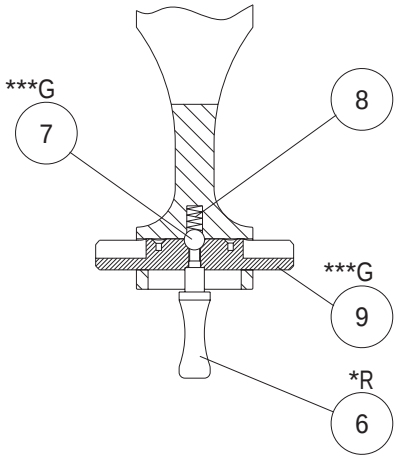
ITEM	DESCRIPTION	PART NUMBER
338	Scavenger, A/C	4106161
339	Chain assembly, 8¼ in.	4112495-006
340	Screw, round hd, 10-32 x ½ in.	HW06007
341	Plug	4102140
342	O-ring, #112 neoprene	4102141
343	Dust cover	1101527
344	Spacer	4110792-007
345	Valve 'A' 5 cm H_2O	2207032
346	O-ring, #027 neoprene	4101871
347	Body, solder assembly	4102105
348	Label, SCAVENGER HOSE (2x)	4104806
349	Label, EXHAUST	4106878

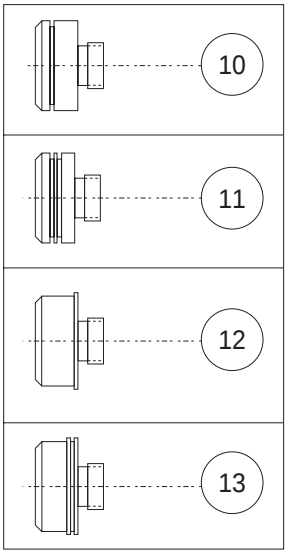
Mounting hardware for scavenger:

	Screw, 10-32 x ½ in. cap skt hd (2x)	HW01025
	Lock Washer, #10 split (2x)	HW65003
	Flat Washer, #10 (2x)	HW66003
	Scavenger Bracket. . . .NAD Color. . . 4106231	Euro Color. 4114027
	Bracket Clamp. . . . . NAD Color. . . 1101301	Euro Color 1101301-001
	Screw, ¼-20 x 1 in. rd hd sltd (2x)	HW06010

350	Vent Grill Adapter (for 19 mm hose)	1101312
351	Screw, round hd, 10-24 x 3 in. (2x)	HW06012
352	Toggle nut (2x)	4101862
353	Label, SCAVENGER HOSE	4104806
354	Deleted	
	Hose Barb Adapter	4108114







***G=Molykote 55M Grease
**P=Loctite #222(Purple)
*R=Loctite #271 (Red)

ITEM	DESCRIPTION	PART NUMBER
1	Vapor Mounting and Exclusion System	4115019-003
2	O-rings, Vaporizer Mount (4x)	4115864
3	Vapor support	4117812
4	Quarter-turn socket (2x)	M28935
5	Socket mounting screws (4x)	1334514
6	Slider handle	M27143
7	Ball, detent	1270621
8	Spring, detent	A10594
9	Slider	M27142
	Bumper depth adjustment spacers:	
10	Spacer, vapor exclusion, -0.020 in.	4117817
11	Spacer, vapor exclusion, -0.040 in.	4117818
12	Spacer, vapor exclusion, +0.020 in.	4117819
13	Spacer, vapor exclusion, +0.040 in.	4117820
	not shown:	
	O-rings, vaporizer storage position (2x)	4115864

ITEM	DESCRIPTION	PART NUMBER

Miscellaneous Items

Touch-up paint: Euro white	7900380
Touch-up paint: Euro blue	7901261
Spray Paint: Euro white	S000094-002
Spray Paint: Euro blue	S000094-003
Loctite #272 (Red)	4118558-003
Loctite #425 (Blue)	4118558-008
Loctite #222 (Purple)	4118558-001
Loctite #545 (Hydraulic/Pneumatic Seal)	4118558-010
Dow Corning High Vacuum Grease	4105908
Belray Anti-Seize Molylube	4118636
Parker Seals Super-O-Lube	4118689
Molykote 55m Grease	4115127

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Printed in the U.S.A.

Narkomed GS Service Manual

Rev. AB summary of changes

Cover . . . . . Changed Rev., and Date
8-39 . Changed P/N of item #254, item #275, and sub-item of #275 Description and P/N

Rev. AA summary of changes

Cover . . . . . Changed Rev., and Date
6-1 . . . . . Changed P/N of Test Lung
6-4 . . . . . Changed P/N of Test Lung
8-12 . . . . . Added item #62A
8-13 . . . . . Added item #62A
8-48 . . . . . Added two P/N for Spray Paint and P/N for the TBD

Rev. Z summary of changes

Cover . . . . . Changed Rev., and Date
TOC . . . . . Updated Section 8 of TOC
8-6 . . . . . .Added application details of Misc. items to illustration
8-8 . . . . . .Added application details of Misc. items to illustration
8-14 . . . . . .Added application details of Misc. items to illustration
8-15 . . . . . Deleted two sub parts found after item 85
8-16 . . . . . .Added application details of Misc. items to illustration
8-20 . . . . . .Added application details of Misc. items to illustration
8-28 . . . . . .Added application details of Misc. items to illustration
8-29A. . . . . .Added application details of Misc. items to illustration
8-30 .Added new parts 192A, B, and C, resequenced item numbers, and added application details of Misc. items to illustration
8-31 . . . . . .Added new parts 192A, B, and C, and resequenced items
8-31A. . . . . .Added application details of Misc. items to illustration
8-32 . . . . . .Added application details of Misc. items to illustration
8-34 . . . . . .Added application details of Misc. items to illustration
8-38 . . . . . .Added application details of Misc. items to illustration
8-40 . . . . . .Added application details of Misc. items to illustration
8-41 . Expanded description of item 288, added new part number for item 288
8-41A. . . . . Added new figure (Aux. Flowmeter)
8-41B. . . . . Added new parts list for new figure
8-42 . . . . . .Added application details of Misc. items to illustration
8-46 . . . . . Updated illustration to add field serviceable parts

8-47Updated parts list to add field serviceable parts
8-48Added Miscellaneous Items listing

Rev. Y summary of changes

CoverChanged Logo, Rev., and Date
TOCChanged Logo
4-59Corrected figure reference in step 4.20.9
8-5Changed P/N for regulator rebuild kit
8-33Added new check valve information
8-37DRemoved second entry for item number 5
Back CoverChanged Logo

Rev. X summary of changes

Updated Cover
Updated LOEP
Page 6-27Changed paragraph 6.14.11

Rev. W summary of changes

Updated Cover
Updated LOEP
Updated TOC
Replaced Section 6 in it's entirety to support PMC reduction effort. All pages in Section 6 have returned to a - (dash) revision level.

Rev. V summary of changes

PageDescription

8-12, 8-13Added heat sink O-rings to lamp asm